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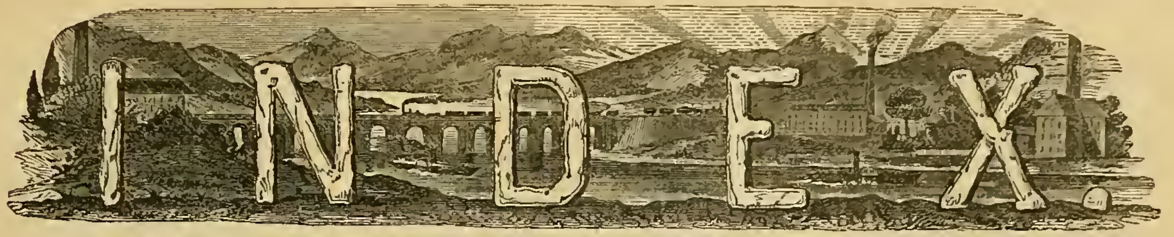

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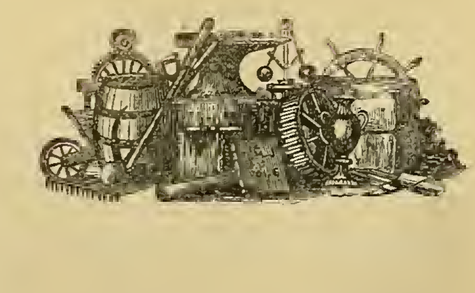

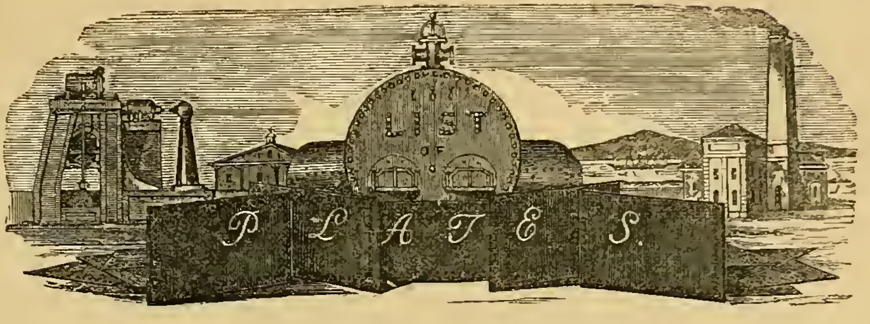

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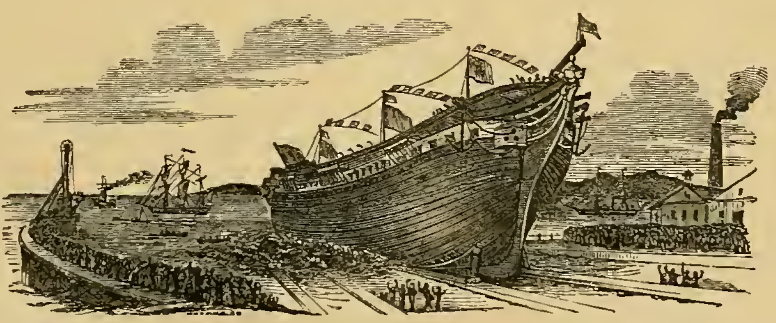

THE

PRACTICAL MECHANIC'S JOURNAL.

> "Nature, in truth, divides her work. To one man she assigns the task of ORIGINATING the new thought; to another that of IMPARTING to it a fitting shape, and adapting it to the uses of mankind. So DISCOVERIES become known and spread, and the knowledge that would have been wasted on a few becomes available for all."—LEWES.

> "Every STRUCTURE or MACHINE, whose design evinces the guidance of science, is to be regarded not merely as an instrument for promoting convenience and profit, but as a monument and testimony that those who planned and made it, had studied the laws of nature, and this renders it an object of interest and value, how small soever its bulk, how common soever its material. Thus it is that the commonest objects are, by science, rendered precious; and in like manner the ENGINEER or the MECHANIC who plans and works with understanding of the natural laws that regulate the result of his operations, rises to the dignity of a Sage."—RANKINE.

> "The judgment of many must unite in this work; EXPERIENCE must guide their labour; time must bring it to PERFECTION; and the feeling of inconveniences must correct the mistakes which they inevitably fall into in their first trials and experiments."—HUME'S ESSAYS.

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

IT is worthy of remark that, whatever may be our own preoccupations, the events which are taking place around us, in their turns, force themselves energetically upon our attention, and, in the words of the Latin poet, "will not allow us to forget them"—*non sinent esse immemores sorum.* Of late this has proved to be more than usually the case; and the sad accidents by flood and field which have so painfully excited the public, have caused men to inquire seriously why these things need be, and whether, after all, much of the blame now cast upon "inevitable accidents" ought not rather to be borne by the parties entrusted with the control of the new forces man has lately made the servants of his will. It may be worth our while, as Practical Mechanics, to dwell a little on these matters; for we have a direct interest in avoiding the creation of any popular prejudices against the means by which we live, even if we allow ourselves to overlook the interests of humanity in general.

The first subject of this nature which has arrested public attention, was the accident at the Risca Colliery on 1st December of last year, and of the Hetton Colliery on 20th December. In fact, in four of the most serious colliery accidents of 1860, no less than 242 of our fellow creatures lost their lives, and the smaller accidents of the same kind, during that period, would, no doubt, sadly augment the list of sufferers. Surely, with all the resources of our modern science, these awful tales should not be thus frequently repeated; and our progress in social organization can hardly be considered satisfactory when our authorities avow their incapacity to prevent the recurrence of explosions which slay their hundreds at a time. Why do we pay for inspectors of mines—why establish mining schools, if the operations of mining are to be attended with no more security than they were in the days when every pit-holder did what was right in his own eyes? How hard, too, it seems to be to arrive at the truth of the causes of these periodical sacrifices of human life! We hear of explosions, and falls, of blowers, and accumulations of fire-damp; but surely, if the workings of the mines were conducted with proper precautions, and if the ventilation were entrusted solely to persons able to appreciate the responsibilities of the duty they undertook, the disengagement of gases ought to be under far more efficient control than it now is. The blowers seem to be most frequently met with in pillar-working, but all the conditions under which the gas accumulates are sufficiently known to allow of its being removed, or so far diluted with atmospheric air to prevent explosion. Practical miners are, at the present day, divided in opinion as to the respective merits of the natural or of the mechanical ventilations, and it would, under these circumstances, be injudicious to attempt to enforce the general, or the exclusive use of either of them. Nevertheless, there are so many manifest advantages in the mechanical ventilation, and it is so especially applicable to the purpose of draining off gases, that it seems, to us at least, that it should be compulsorily employed in all workings where danger of this description exists. It is precisely by the study of such questions as these that mining schools are likely to achieve good; and our Government inspectors would far more efficiently protect the interests of the population entrusted to their care by diffusing correct ideas on the best modes of ventilation than by the course of petty interference they seem disposed to adopt. Be this as it may, the number of accidents in coal mines has certainly not diminished of late years, and in that respect, at least, the Government inspection of mines has not produced the results the public were entitled to expect from it.

The last winter, also, was characterised by a fearful number of railway accidents, from which little attempt to draw a moral has been made. It is insinuated that iron and steel are subject to certain changes in their physical nature during extreme cold; and no doubt this is true to a certain extent. There are, however, other physical causes at work upon railroads, or rather the same cause acts upon other materials employed in their construction, which have not met with the attention they merit. Thus, the ballast becomes frozen, and if it should have happened to have been charged with water at the time, the expansion of the water is very likely to derange the permanent way, whilst upon the occurrence of a thaw, the way is certain to be affected. Yet the managers of our railroads make very little allowance for these disturbances, and the trains are expected to maintain the same rates of speed as they would do in normal seasons. A correspondent of one of the railway journals observes, that in Norway, where temperatures of from 2° to 26° below zero are by no means uncommon, no accidents arose from the fractures of tires, axles, or other parts of railway plant, although those parts were all made of ordinary English iron; but the rate of travelling in that country does not exceed 20 or 25 miles per hour, whilst here the rate often exceeds 40 miles per hour. The British public would perhaps object at first to the slackening of the speed of trains in winter, but the temporary inconvenience would be far more than counterbalanced by the increased safety; and the shareholders, it may be suspected, would find that they would gain much by the absence of claims for compensation. As to the accident on the South-Western line, in which Dr Baly lost his life, it is very singular that nobody has yet called attention to the possible contingency of its having been caused by some derangement of the meeting-points on the main line. The causes hitherto suggested have been theoretical enough. Is the one thus referred to of a nature so simple as to have escaped inspectors and professors? Of this, at any rate, we are convinced—from a practical acquaintance, too, with the maintenance of a railway—that meeting-points are, at all times, a source of danger, and that they ought not to be allowed in any part of a line where the trains can run at full speed. So convinced, indeed, are we of this fact, that we would even desire to see it recognised by the standing rules of the Legislature; and we hold that it should be rendered imperative that meeting-points should only be placed near stopping stations. No locomotive should ever be allowed to pass a meeting-point at a velocity exceeding four or five miles per hour. To pass one at 25 miles an hour is merely an act of foolhardiness.

There is another sad tale of loss of life and destruction of property still to be noticed, namely, the one caused by the storm of the 8th of February, and awful, indeed, must its consequences have been; whilst the cool, easy indifference with which the authorities of the country treat the recurrence of these misfortunes, has been displayed in such a manner as to rouse feelings of deep indignation in the minds of all who have suffered by them. It seems that no less than 210 vessels had been posted at Lloyd's as having been lost by Wednesday, the 13th February, and it has been calculated that the total number cannot have been less than about 300. The number of lives then sacrificed is not known, but it cannot have been below three or four hundred, and the value of the property destroyed might almost, without exaggeration, be reckoned by millions. Lord Palmerston had the singular bad taste to speak of this calamity almost as though it were a joke, and when appealed to in Parliament, with the view of ascertaining the intentions of the Government with respect to the creation of harbours of refuge, he could only find a few words of course for the lost sailors, and content himself with advising shipowners to insure. Possibly the country may gain by the Government's not undertaking the formation of the proposed harbours; for the results of the works lately executed at Harwich, Dover, Holyhead, and Alderney do not warrant the belief that the official advisers of the State in these matters are capable of grappling successfully with the requirements of the commercial marine. But why are we thus always to be condemned to witness the waste of public money through official incapacity, or to suffer heavy losses because Government engineers cannot do what ordinary engineers would be perfectly able to carry out to a successful issue? On the French coast there are numerous harbours of refuge, many of them of recent construction, and built expressly for the safety of the vessels engaged in the coasting trade. Our Admiralty, it may be suspected, are hardly aware of the existence of some of these ports, for we know, from very good authority, that it was only within the last twelve months that "my lords" *discovered* the growing establishment of St. Nazaire, and the names of such small nests for "mosquito fleets" as Courseulles, Port en Bessin, St. Brieuc, &c., are hardly likely to have penetrated to their ears. Be this as it may, the French have profited well by the lessons we gave in the creation of Ramsgate Harbour, whilst we continue to suffer, year after year, the dreadful losses recorded by our wreck chart, without attempting to guard against them. It is true that the meteorological department of the Board of Admiralty have issued some useful instructions in the indications of the barometer, and have favoured some ports with telegraphic warnings of coming danger, but, oddly enough, the department seems to have no communication with some of the most important shipping towns, and the warnings were not given in February where they were most needed. Our sailors, too, have little confidence in the new science, and have still to learn that there are "laws of storms;" but this very fact seems to us to prove that good schools of navigation are quite as much wanted as schools of mines. We require educated sailors quite as much as we require educated miners, and the interests involved in the one pursuit are at least as great as those involved in the other.

There are some curious remarks to be made with respect to the statistics of London fires lately published, but the most interesting one to our readers would, no doubt, be connected with the comparative security of gas over candles. It seems that as many as 232 fires were caused, in one way or another, by the use of candles, whilst only 98 were attributable to gas, and of these 18 were known to have been the result of carelessness. Such records as these would go far to destroy the prejudice against the use of gas in dwelling houses which still prevails in the southern parts of England, and we have therefore reprinted them in another part of this number.

It is strange that great nations should at times exhibit the same propensity for imitation which may be observed in individuals; and just at present we seem to furnish an illustration of the remark by our eager imitation of the French Emperor in his works for the improvement of his capital. London is undergoing a remodelling of its communications, and lines of railway, new sewers, and new streets are being formed in every direction; there appears even to be a probability that the Thames embankment may be seriously taken in hand by the Government, and, consequently, spoiled. Lord Derby seems to regard the concentration of labour which thus takes place as an evil of serious magnitude, and, in common with many other philanthropists, he holds these works, to some extent, responsible for the evils attendant upon the overcrowding of lodging-houses. Without disparaging the efforts of his lordship to bring this serious social problem before the Legislature, we must differ from him in his appreciation of the effects of the works in question; for the temporary increase of employment in any one part of such a hive as our metropolis is, comparatively speaking, without influence upon the habits of its population. London workmen do not follow their work, as a rule; and it is even questionable whether any appreciable increase of the labouring class has been produced by all the great things now being done. As to the mode in which these operations are being conducted, it often strikes us with surprise that so little use should be made of the modern appliances of mechanical science upon them. The excavations for the new sewers, and for the underground railway, are carried on nearly in the same manner as the one in which they would have been done twenty years since; nor, excepting in the case of the southern high-level intercepting sewer, and in some parts of the New Road, and in Hyde Park, are we aware that the steam-engine has been applied to abridge the heavy manual labour of the earthworks. The character of the strata traversed on the south side of the Thames is, however, of the precise nature fitted for the application of the American excavator, which attracted so much attention about sixteen years ago; for the sands and loams at the bottom of the London clay are light and perfectly uniform, so far as their resistance to a digging tool is concerned. Our French neighbours seem to be taking the lead of us in these matters, and, at any rate, the machinery they have lately applied in some of the large building operations of their cities is far in advance of any adopted in England. Perhaps the scarcity of labour may induce our contractors to bestir themselves in this direction.

The controversy between Sir H. Douglas and Mr Scott Russell, on the subject of iron ships, has led to the publication of some smart pamphlets or letters on both sides, but public opinion seems to have gone entirely with the advocates for iron defences against wooden walls. Sir H. Douglas, in this particular instance, has certainly made a mistake in his sweeping condemnation of iron ships, and he has been very unfortunate in some of his remarks upon the results obtained in the Great Eastern. For transport service there cannot remain a doubt in the mind of any competent inquirer as to the immeasurable superiority of iron vessels over wooden ones, in every respect; and, for fighting ships, Sir Howard himself shows that the whole question of the use of iron is narrowed to the difficulty of applying it. It is important that our authorities should turn their attention to this part of the inquiry, for we hold that, in the cases of the Warrior and of the Black Prince, a very serious mistake has been made in backing the plates by the teak lining. Dry rot must almost of necessity take place in the timber; and it is more than questionable whether vessels so built would last five years, if at least an opinion may be formed from what occurred in the case of the Trusty. The remedy for this evil is a very simple one. It is to construct the ships entirely of iron, and, if Sir H. Douglas be correct, to make the thickness of the plate six inches. The weight of the wood lining thus saved would go far to compensate for the extra weight of metal. Another advantage in such a course would be, that the whole ship would be invulnerable, instead of presenting compartments at the stem and stern (as in the Warrior and Black Prince), which may very possibly prove to be sources of danger in action. Many criticisms might be made on the design of the Warrior, and many of its details would, no doubt, admit of improvements; but, until some decision is arrived at with respect to the constitution of the Board of Admiralty, it would be of little use to dwell on the shortcomings of the first trials of a new class of vessels. It is to be hoped that some change will at least be made in the department of the Surveyor of the Navy, also, that the body of naval architects may be placed in a position more in accordance with their merits and with their responsibilities than the one they now occupy in the service.

The efforts of our mechanical engineers to introduce the use of coal in locomotives, instead of coke, are being steadily continued; and it certainly would appear that hitherto they have been attended with sufficient success to warrant the hope of their ultimately effecting the desired object. In the mean time, it may be worth while to call the attention of our readers to the attempts which have lately been made by the engineers of the Central Railway of France, to introduce in that country the use of anthracite coal, in the same manner as it is used in the American locomotive. There are deposits of this fuel in our own country, which might be thus made convertible, and we shall, for our own parts, watch the French experiments with great interest. Any new source of supply of combustible, in the busy parts of central France, must be a matter of interest to the well wishers of humanity in general; and it may even be that the application of the anthracites of this district may affect the importance, in a political point of view, of the newly discovered Port St Nazaire. In the meantime, and without reference to the possible effects of the competition of other sources of supply of coal from our own, it is reasonable to suppose that the investigations to which the respective classes of experiments above mentioned must give rise, will induce our engineers to turn their attention more than they hitherto have done, to the economical application of the calorific powers of the combustible used in locomotives. The useful effect produced by the combustion of a given weight of fuel in that class of engines, is still considerably less than it ought to be, in comparison with the rates of consumption in fixed engines, and the economical results of working expansively, are far less in the locomotive, than we should be entitled to expect.

A new application of steam power seems, we are extremely happy to say, to be likely to revive the prosperity of a class of property which has of late been treated with unmerited neglect. In so saying, we allude to the attempts now being made to construct steam-boats for the use of the Grand Junction Canal Company, which are said to have been attended with considerable success. The great problem to be solved in this case, is the arrangement of the motive power within a very small space, and it may possibly be found, hereafter, that the gas engine of M. Lenoir, or some new power, may be adapted to this purpose, on the score precisely of its very small volume. Another difficulty arises in the form of propeller to be used; but, in face of the results actually obtained on the Grand Junction Canal, and upon the Dutch and Belgian canals, there can be no reason for despairing of our engineers being able sooner or later, to surmount it. As for the apprehended destruction of the banks of the canals, it has been found that, practically, that danger has been exaggerated, provided always that the speed of the boats do not exceed six or seven miles per hour. We will return to this subject of canal navigation in a future number, for it is far too important to be treated incidentally, whether the mechanical or the commercial bearings of the questions involved, be considered. The last remark may likewise be extended to the analogous question of tramways for street traffic; and as a practical experiment of this system of traction is now being made on a large scale in the Bayswater Road, we shall watch its results carefully. Our own experience of these street trains (which certainly was only obtained in the early days of the system, as applied in the United States,) has been very far from a nature to inspire us with much prepossession in its favour. Experience may, however, have enabled the promoters of the new forms of tramways to obviate the inconveniences of the original ones; and we, therefore, suspend our judgment until we can see the Bayswater Road tramway in operation. It may possibly be the case, that the proposed Thames embankment may provide a suitable opportunity for a new experiment of this description, should Mr Cowper succeed in bringing that very desirable improvement to bear. Unfortunately, the course adopted by the First Commissioner of Works, has been such as rather to provoke opposition to the scheme, than to facilitate its execution; so that both tramway and embankment between Westminster and Blackfriars are likely to be deferred to the Greek calends, unless the railway companies succeed in obtaining legislative powers in the matter.

It may be worth while, before closing these remarks on the current events of the world of science connected with practical mechanics, to call attention to a singular application of the power of the electric light, which has lately been brought before the public at the exhibition of the Photographic Society. Professor Way and Mr Bedford have here exhibited some plates produced by the apparatus invented by the former of these gentlemen, in which the pencil of rays is obtained by the action of electricity on a capillary stream of mercury; and certainly, from those plates, it would appear that, as Dr Gladstone has already remarked, the actinic rays of the electric light are even more powerful on the prepared plates, than those of the sun itself. There may be, in this new application of the electric light, the germ of a complete revolution in the mode of illustrating books; for it certainly furnishes the means of reproducing, in countless numbers, and in a very short space of time, copies of original drawings and of photographs. For the reproduction of technical and scientific designs, this modification of photography must be of especial value. By the way, our Admiralty are said actually to be engaged on some experiments as to the applicability of Way's electric light to night signals: this would be so reasonable and so common-sense a course of proceeding, that, alas! it would almost be incredible on the part of "My Lords!" In Paris, we would add, men of science seem to be more earnestly directing their attention to the general application of electricity as a motive power, than we are in England; and it is even stated that a large machine making establishment is being constructed in that town, in which electricity will be the only power employed. With coal at its present price, the success of such an experiment must however be problematical.

HEAT IN ITS RELATION TO WATER AND STEAM.

IV.

The relation that subsists between heat and water is a question which, at the present time, more than at any former period, is engaging the attention of the philosopher and engineer. This arises mainly from a desire to economise fuel. We must frankly admit that we have not as yet definite ideas of the molecular forces which induce the condition of heat, and the fluidity of liquids, so that on these questions we are free to advance such ideas and principles as will bear the test of experiment. Before offering any opinion, it would be well that we first carefully examine the leading principles, testing their correctness as far as possible by practical experiments, and from these deduce probable results.

That we may clearly understand the leading principles on both sides of this question, I will again state them in as few words as possible. By many philosophers it has been maintained that the sensations of heat arise from the presence of a subtle elastic fluid, which has been termed caloric, supposed to be present in all bodies, differing in quantity according to the temperature of the body, and its capacity for heat. By others it is supposed to consist in the vibrations of the particles of bodies, the particles of the hottest bodies moving with the greatest velocity: these vibrations being communicated to all bodies in contact with it, and hence give rise to the sensation of heat and the effects that follow.*

The first question is, what is Heat? Many theories have been advanced on this important question, but still we are without the answer. On mechanical principles we readily reply, it is friction; then we ask what is friction? it is motion, so that heat is a consequence of energy or motion; then, what is motion? is it a quality of matter or independent of it, in what form is it presented to our senses? In all our various sensations, it induces those varied motions in animate and inanimate matter that are in constant action throughout space. The theories of ether and imponderable fluids are giving place to those of electrical influence. Let us endeavour to trace heat in all its relations to matter. We will assume the hypothesis that matter is inert, that is motionless, lifeless; and that energy or motion may be exerted on it, and that matter is imponderable to a certain extent, in so far, that by certain arrangements of its atoms it gives resistance to motion or energy. We may conceive a time when all was still, and that impulse was given to inert matter. Then the first law of motion is, that a body would move on in a straight line for ever, if not restrained by its inertia. We have thus the first conditions of energy and matter, this energy co-existent with matter, but independent of it.

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* In papers read by me, on heat, before the Philosophical Society of Glasgow, in 1852, I endeavoured to combine the two theories, and I well remember that I was far from being satisfied with such a combination, and from that time have adhered to the theory of energies.

We will now proceed to inquire what those relations are, which subsist between what we shall call electric energy and innate matter; it is becoming generally admitted that electricity, magnetism, heat and light, and the molecular and cosmical forces, are but modifications of the same great primary cause; and when viewed in all their varied relations, they seem converging towards one centre, from which radiate those great principles which will guide us in all our researches, electricity being one of its keys. Electricity is a power which we only know by its effects. It seems to be capable of action in all directions, moving innate matter by determined laws which could not be sustained without a governing power to which those attributes belong. We are acquainted with the transmission of its powers through apparently imponderable bodies, as well as water, air and gases, it induces chemical action, and presides over chemical affinities and cohesion. Its indivisible action is made known to us through its energies on material atoms, and the variableness of its motion can be conceived from the diversity of its action on these; the reconstruction of their masses thus conveying to our senses, the perception of attraction, repulsion, heat, light, sound, smell and taste, all being produced by minute vibratory movements.

It may be as well that we now refer to our former experiments with the metals. When heat was applied, the first effect produced was contraction. Why this contraction before expansion? Does it not seem evident that the structure of the composing atoms are undergoing a change, of what may be called their molecular structure preparatory to expansion, and *vice versa*, when the heat is removed. The same law is clearly indicated by the fluids. From the following facts it will be observed that we can form magnets by physical energies, by chemical energies, and by heat, and also that we can apparently destroy magnetism by heat.

Now, let us suppose that we take a bar of iron of any convenient length, and holding it in an easterly and westerly direction, strike it a smart blow, no particular effect is produced; but if we hold it north and south in the magnetic meridian, or at an angle of 70°, and strike it a similar blow, it at once becomes a magnet, indicating polarity. We know from experiments formerly given, that the structure of the atoms composing the bar have undergone a particular change in their arrangement, which continues so long as the polarity is indicated; thus showing that magnetism is not a property of the bar, but simply co-existing with it, and being indicated by a certain arrangement of the atoms of which the bar is composed.

Having fixed a permanent steel magnet, which was formed by a battery, in the pyrometer cistern, it was made to deflect a sensitive suspended needle equal to 45°: when the heat was applied, the thermometer in the oil indicated 50°, and when it indicated 75°, the needle all at once leaped 1°, thus clearly indicating a change in the internal structure of the magnet, as, after this, the magnetism continued to decrease in a proportional ratio. At 500° of heat, the deflection was equal to 22°, thus clearly indicating that at a heat somewhere about 1100°, the needle would indicate zero, this again showing that the induced magnetism of the bar entirely depends on the arrangement of the atoms composing the body, until the repulsive forces become as one.

A magnet may be formed by heat, when in the act of hardening it, by immersing it in the line of the magnetic dip, its polarities will then be distinctly indicated; but if dipped or immersed east and west, its polarities are indefinite.

Before proceeding with the inquiry as to the relation subsisting between electrical energies and water, it may be well that we assume an hypothesis, so that in our process of reasoning we may keep the following propositions clearly in view.

First. When expansion takes place, the equilibrium of the molecular vertices become gradually suspended, and the dynamical energies (these being an extension of the molecular energies) increase in a proportional ratio. The atoms of water in the vapour form having a greater capacity for electrical or magnetical influences, are by this means repelled from all parts of the fluid into space.

Second, When the fluids begin to resume their former density, the dynamical energies decrease in a like proportion; and thus by heat or energy a polar arrangement of the atoms or particles is formed.

Third, The various arrangements of the atoms producing all the diversified motions in inert matter, these depending on one great primary cause, viz., energy or motion, which, as we have said, is co-existent with matter, but independent of it.

Fourth, That the particles or molecules of matter arrange themselves in a particular way when expanding, and re-arrange when contracting; and it is the particles so changing their arrangements, if we conceive them to be of a cubic, prismatic, triangular, spheroid, or oblong form, which causes contraction at the beginning and expansion at the end.

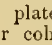
In examining the relations that subsist between electrical energies and water, it will be necessary that we keep clearly in view the magnetical laws—as attraction, repulsion, inducing, and receiving—to these I would propose to add expansion and contraction, as forming part of the fundamental principles. The former I am inclined to view as magnetical indications, or modes of giving expression to our ideas, and not laws; it must be admitted that there is a poverty in our language which prevents us from expressing our ideas clearly on this branch of physical science. I therefore propose that we reason as closely as possible on the following definitions—First, energy; second, polarity; third, expansion; and fourth, contraction. These appear to me to form distinct principles of action. In order that we may more clearly understand these definitions, let us suppose that we take a series of small triangular steel plates, and combine them so as to form a parallelogram similar to the engraving, (see plate 271, fig 1), taking care that the reed, or grain of the metal; runs in one direction; when they are bound together, magnetise them, by any convenient mode, and they will form a combined magnet, each end indicating polarity. If we now separate the triangles, each will form a distinct magnet of itself. Suppose each cube or triangle to represent certain forms of atoms which compose the mass of matter, however different the atomic forms of matter may be, these, at least, convey to our ideas certain atomic forms of arrangement.

By referring to the engraving plate, 271, fig. 2, it will be observed that the polarities of the cube, marked N and S, are so arranged as to attract each other, this indicating cohesive energy, and hence also indicating the appearance of solidity.

Fig. 3 represents a cube and triangle attached. By this arrangement, it will be observed that the solidity is not so complete as in the former, the S, S, poles repelling each other, while the N, S, attract each other, this arrangement weakening the solidity of the mass, and making it more sensitive to the dominant energy of heat.

If we change the position of one of the triangles, forming a figure similar to the annexed cut. See also fig. 4, plate 271; and if we suppose the triangle A to represent an atom of hydrogen, and the triangles B and C proportions of oxygen, in this arrangement the S, S, S, are repelling each other, and the N, S, attracting each other. This arrangement, so far, represents to us the components of water, and the repulsion of the S, S, S, convey an idea of the cause of fluidity, and when the energy of heat is applied vapour or steam is the effect. The energies S, S, S, convey to us an idea of the cause of the latent heat of fluids, and the light vapour which arises in the absence of sensitive heat.

By reversing the triangle A (see fig. 5), it will be observed that all the polarities are repellant, and that neither solid nor fluid can be formed; hence, we can form an idea of the gaseous arrangements—when the energy of heat is applied, their great expansion, and when the energy of force is applied, their great compression, extreme pressure forcing many of them to assume the fluid form.

The next point to be considered is the fluid passing into the solid or crystalline form. By reversing the hydrogen triangle A, we form the annexed fig.  See fig. 6, plate 271, from which it will be observed that the attractive or cohesive forces are nearly in equilibrium, except the weak repulsive energies S, S, which we will call the latent energies of heat. Fig. 7 represent S, O, S, in equilibrium.

In a paper read by Professor William Thomson,* on atmospheric electricity, towards the conclusion he says, "We know that there is no substance of caloric, that inscrutably minute motions cause the expansions which the thermometer marks, and stimulates our sensations of heat—that fire is not laid up in the coal more than in this Leyden jar or this weight; there is a potential fire in each."

Let us now inquire further regarding electrical magnetism and its relation to water. I have, in a former paper, referred to the chemical compounds of water, that is oxygen and hydrogen. Oxygen is supposed to be an element or simple substance, as it has hitherto resisted all attempts to decompose it. It is abundantly diffused throughout nature, forming eight-ninths of the weight of water, one-fifth of the weight of air, and nearly one-half of the solid rock which constitutes our globe, all animal and vegetable substances contain it largely; it is called the vital air, from its great influence in sustaining animal life and combustion.

Hydrogen is sixteen times lighter than oxygen, and nearly fifteen times lighter than atmospheric air. If the two gases be introduced into a vessel, their atoms or particles mingle without coming within each others' affinities, and thus remain until the electric spark is applied, when the energy of explosion combines the particles together. From this it is evident that, if the atoms could be brought into contact, the same result would be obtained. All gases are kept in the elastic state by energy or heat, which causes their atoms to be repelled, producing voluminous bulk. If a portion of the energies, oxygen and hydrogen, be suspended, water is the result; if the two gases be mixed in proper proportions, and subjected to immense pressure, explosion takes place, water being the result. By electricity we can decompose the water, and receive the gases separately, and show their former proportions.

Thus, then, having a clear mechanical perception of water and its for-

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* Royal Institution.

Plate, 271.

DIAGRAMS TO ILLUSTRATE Mr CAMERON'S PAPERS ON STEAM.

Fig. 1.

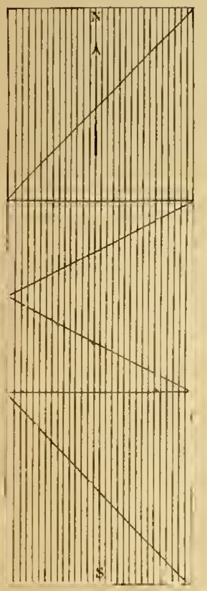


Fig. 2.

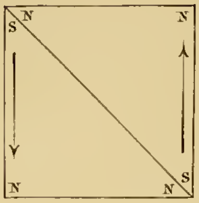


Fig. 3.

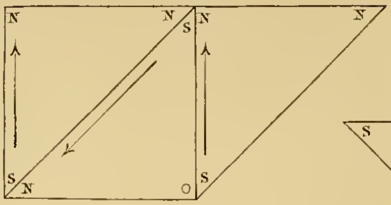


Fig. 4.

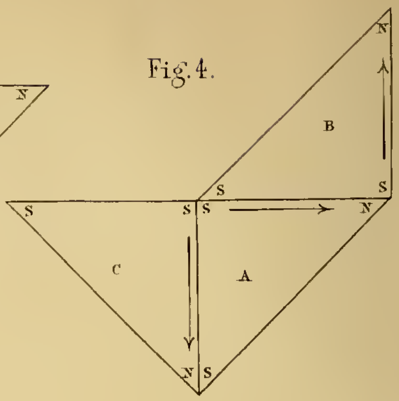


Fig. 5.

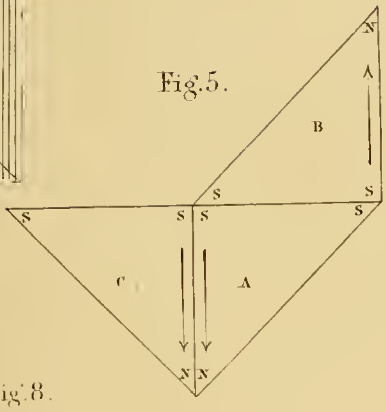


Fig. 6.

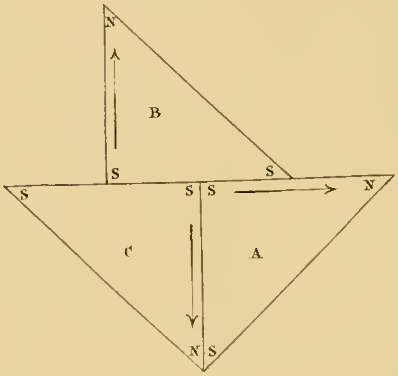


Fig. 7.

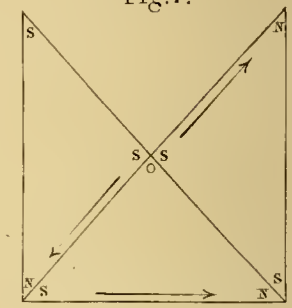


Fig. 8.

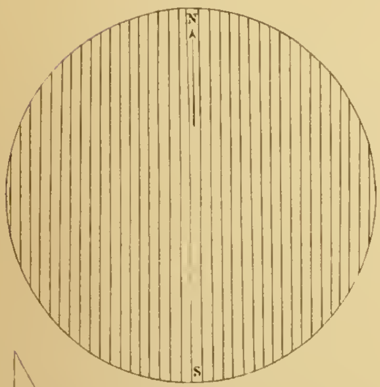


Fig. 9.

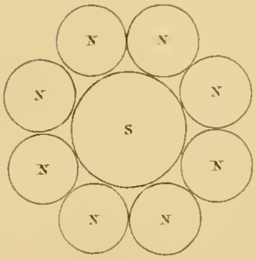


Fig. 10.

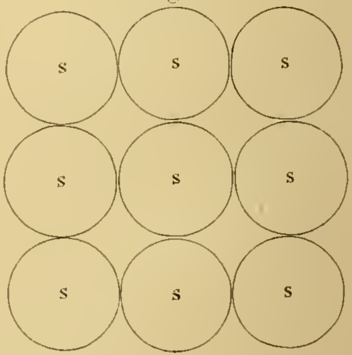


Fig. 11.

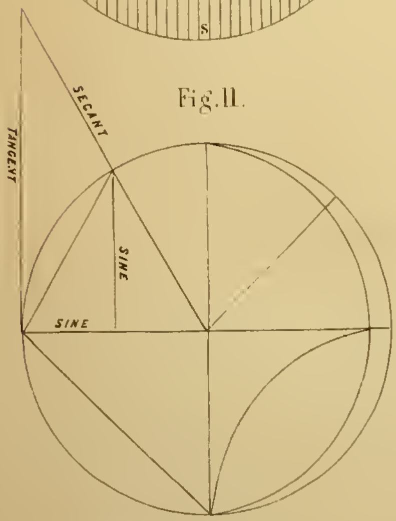


Fig. 12.

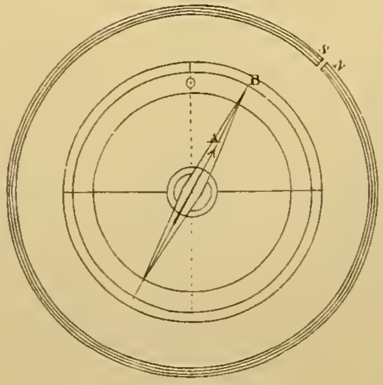
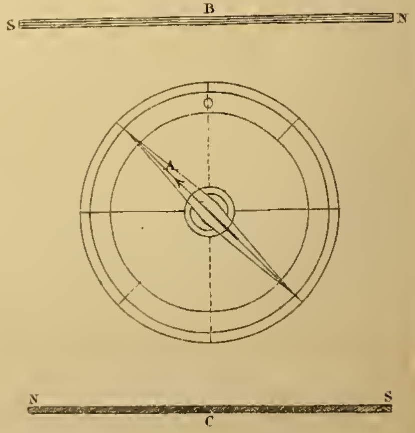


Fig. 13.



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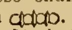
Maclure & Macdonald Glasgow

mation, we now come to the question, What is the amount of energy it contains? In the first place, it appears that the energies which formerly caused the gases to repel each other are now reversed, inducing the energies of cohesion, being nearly in equilibrium when the water is at 39° its point of greatest density. Hence, it must follow that an increase of either of the energies of expansion (see plate 271, figs. 4 and 6); and let us suppose the energies of repulsion to be increased, the fluid assumes the vapour form, its dynamical power depending on the amount of the energy of heat applied. When energy or heat is reduced under 39 degrees, the fluid begins to undergo a change in the construction of its atoms, these changing from the spheroidal and assuming the crystalline form .

It may be said that cubes, triangles, &c., do not apply to fluids and gases, as their atomical structure is supposed to partake of the spheroidal form. Let us now examine how far the theory advanced can be reasoned on this formation. Suppose we get a circular plate of steel, and magnetise it on the turning lathe, we find its polarity indicated in the same line as the reed or grain of the steel, (see plate 271, fig. 8)—the lines indicate the direction of its polarity—let us suppose a series of atoms of the sphere or spheroidal form, each atom having its polarity; it will be evident that the same process of reasoning can be applied to matter in these forms, as in any other form that the mind is capable of conceiving. That we may have a clearer perception, we will now examine the probable construction, (see figs. 9, 10.) Without straining the mind, we can suppose that by compression, or otherwise, the poles of the centre atom may reverse, and thus form water. Fig. 11 is constructed so that we may perceive the modes that may be applied in reasoning on the energies of forces on mathematical principles, from the lines forming the various triangles, as signs, secants, and tangents of energies.

In a paper recently read by Mr Dyer, before the Manchester Literary and Philosophical Society, on the freezing, thawing, and evaporation of water, he says—"If the doctrine of *latent heat* be held as sound, and taken for our guide in this inquiry, it is clear that by it a full explanation of all those changes is at once afforded; and it would be trite and out of place here to explain its application in these cases, were it not that the doctrine of heat being 'latent in bodies' is directly impugned by the supporters of the 'force heat' doctrine, as conflicting with the latter; and it must be admitted that the *two* are antagonistic, and cannot *both* stand. In this view of the case, it seems worth while to examine the application of these opposite heat doctrines to the phenomena in question, in order to see which theory will best agree with, and explain the ascertained facts. I have taken the natural mutations of water for this purpose, because of their being on so vast a scale, and so familiar to every body; and, therefore, far more striking than experiments can be rendered, however carefully made, on small portions of this body. Besides, upon the question whence came the raised temperatures obtained by such experiments? I have before shown that the results were clearly to be accounted for, and explained upon my own theory of 'elemental heat,' (defined in former papers), and therefore, that the production of sensible heat by the experiments of churning or agitating water, could not be received as settling the great questions as to the source or nature of heat."

We are here asked to explain, on the theory of energy or force, the latent heat indicated by the thermometer in the act of thawing. The magnetic needle is the register of electric energy, in the same way as the mercurial thermometer is that of the measure of heat. By the magnetic needle, we can discern the amount of energy given out by the varied conditions of matter. Let us suppose a needle suspended within a circle formed of magnetised steel wire, (see fig. 12, plate 271) the circle is cut at N and S, the needle, A, and dotted line of zero. When the two ends are closely united, energy is not perceptibly indicated by the needle, but the instant the ends, N and S, are opened, energy is immediately indicated by the needle moving from zero to B—its motion depending on the extent of the opening of N and S. In like manner, may we not reason thus, that the atoms which now compose the fluid, when passing into the crystalline state, so arrange themselves that the repulsive energy, for the time, ceases to indicate, the energy being changed to that of cohesion—this condition is so far represented, when the poles of the circle, N and S, are united, the needle returning to zero. In thawing, the 140° of sensitive energy, or heat, is absorbed in overcoming the energy of cohesion; fluid being the result, with a latent energy equal to 140° at 32°. If this liquid is to be converted into the elastic state, an additional supply of energy, or heat, must be obtained from other bodies; 180° and 32°, give 212°—the boiling point, and from 900° to 1000° of latent energy is required to sustain the elastic state of the vapour, and overcome the cohesive action. It is not necessary that we deny any part of the dynamical theory, as its facts can be demonstrated by practical experiments, so that we require no negative power in direct opposition, to harmonise its principles with that of force, so far as I have reasoned on the various arrangements of the atomic forms of matter—*energy* being direct and simple, and only appearing diversified from its action on the different polar arrangements of the atoms.

In another part of Mr Dyer's paper, he says, "If the '*force heat theory*' is to be made to supersede that of latent heat, the supporters of the former are bound to explain, *by it*, the phenomena hitherto so clearly accounted for on the latent heat principle, and they are also bound to find substitutes for the expressions in common use to explain the *facts* connected with the specific heat of bodies."

In Dr Black's law of latent heat, it is held, that whenever a body changes its state or condition, it either combines with caloric, or it separates from caloric. From this, it does not appear at all necessary that we ought to seek to change this great law, as we find from the mechanical arrangements of the atoms of matter, that its various conditions can all be anticipated. Suppose the electric needle, A, and dotted line of zero (see fig. 13, plate 271), the needle indicating zero, and the magnet, B, being placed at a right angle with the needle, the needle is immediately deflected a certain number of degrees, depending on the amount of energy given out. Suppose this to represent an equivalent of heat, if we place a similar magnet, C, parallel with its poles reversed to that of B, the needle will immediately return to zero, from this it will be evident that energy is not destroyed, but simply restored to equilibrium, or latent, the same may be produced by a combination of magnets.

Then let us further examine how far this mode of reasoning will assist us in the question of the relation of heat to water. Suppose we assume a cube of water having a latent energy equal to 140, and a cube of repellant energy or heat equal to 1000; suppose them to be brought within each other's sphere of action, the latent or cohesive energy of the water at first resists the repellant energy until it becomes absorbed by it, thus for a time giving the water the appearance of being a nonconductor, but as the water increases in heat its conduction increases in a similar proportion, and when at 210° its conduction of heat may be said to be instantaneous; at 212°, when the steam is allowed to escape freely, the forces may be said to be in equilibrium, but if the vapour or steam be confined the expansion of pressure immediately takes place, and the sensitive heat of the fluid and vapour gradually increases; at 212°, the sensitive heat of the water and steam is 180°, the latent heat being 1000°, making together 1180°, if we substract all the sensitive heat above 212° from the latent heat, we find the latent heat of steam at the different temperatures, as 212° equals 1000°, 250° equals 962°, and so on. From this it appears that when the sensitive energy or heat is 500°, the latent is also 500°, the two energies being equal. From experiments I have made in superheating steam—at 500°, its dynamical energy seemed to be suspended when cut off from the fountain of supply, thus indicating an equilibrium of the energies. There is another form in which repulsive energy is indicated. When water is dropped from a sponge on a plate highly heated, it immediately assumes a spheroidal form indicating vibratory motions, and for a time seems to resist evaporation, this again indicating repulsive energy.

Lest it be inferred from my using the terms polarity, polarities, energy, energies, that I believe in a plurality of electrical influences, I may state, that I believe simply in one great primary energy, the diversity of its motions being derived from a polar arrangement of the atoms of matter.

[The greater portion of this MS. having been in the hands of the printer, previous to my reading Mr Dyer's paper, I must defer the further consideration of it to the next number.]—PAUL CAMERON.

ON THE USEFUL EFFECT OF STEAM BOATS.

UNDER the above title, the Rear-Admiral Paris presented to the Academy of Sciences, on the 31st Dec., ultimo, a paper which was designed to elucidate the conditions which indicate the actual service rendered by the fuel employed in steam boats. As this paper may merit the attention of our own mechanicians, it has been condensed as follows:—

After observing that hitherto no attempt had been made to ascertain the relation between the power exercised by marine steam engines and the combustible used in them, (although there was, in fact, a greater necessity for studying this question, than there was in the case of land engines, on account of the value of the stowage room occupied by the store of coals,) Admiral Paris says that perhaps this apparent negligence may be explained by the difficulty of ascertaining the value of the resistance of the vessels when passing through the water at different velocities, and with different dimensions and outlines. He also repeats the well-known observation, that ships, whether moved by sail or by steam, are exposed to irregularities of action, which have not hitherto been found to be reduceable under any known laws; but he considers that, in order to arrive at any relation between the consumption of coal and the resistance, it is necessary to take for granted certain principles; as for instance, that the resistance increases in proportion to the square of the velocity and the area of the mid-ship section immersed. If, under these conditions, 1 horse-power were required to give a velocity of 1 knot, it would require 8 horses-power to give 2 knots; 27 horses-power to give 3 knots; more than 1700 to give 12 knots; and 8000 for 20 knots. As the combustible burnt is in the ratio of the power employed, it must be evident that the increase of velocity must always be attended by a rapidly increasing consumption of fuel; and it thence follows that, for sea-going vessels, there is a limit to the attainable velocity, dependent upon the weight of the machine and of the combustible. It likewise follows that the power exerted in the passage between two ports, must be in the inverse ratio of the time employed in the passage.

It would appear, at first sight, that the best mode of appreciating the services rendered by a steam vessel would be, to ascertain the quantity of coal burnt in order to transport a ton of merchandise a certain distance—a minute of a degree, for instance—but, as was above stated, the velocity will affect the value of this indication to a serious extent. It becomes, then, necessary to reduce the indications to a normal velocity, such as 10 knots—and the services of the vessels of some of the large commercial companies have been for years calculated in this way. They are grouped in tables, and represented graphically by curves, whose abscissæ are the number of grammes burnt, and whose ordinates are the displacements. The mere inspection of these tables is sufficient to demonstrate the superior economy of large ships, inasmuch as, by such a process, it is shown that a ton is transported a certain distance by the Algesiras at the cost of 45 grammes of coal, whilst by the despatch-boat Ariel it costs 227 grammes. This system, however, can only be applied correctly when the dimensions of the ships compared are the same; but it at any rate shows that it may happen that the steam power of one vessel may cost twice as much as that of another, accordingly as it may be well or ill managed. The model of the ships, it may be added, has a marked influence on the cost of their useful effect.

As the velocity rendered the above system, to some extent, inapplicable, Admiral Paris endeavoured to discover some other one of a more universal nature. For this purpose he resorted, firstly, to the use of the Watts's indicator, and he adopted the process employed by Messrs Bourgois & Moll in their researches upon the screw propeller. These gentlemen admitted the principles already stated, and they calculated the useful effect produced by means of the formula $\frac{K\,B^2\,V^2}{\text{power by indicator}}$ in which B^2 is the midship section; V, the velocity, and K, a coefficient, derived from the nature of the ship and of the propeller employed. But this formula does not give results in the form required by the shipowner, or by the sailor, for the first requires to know the money cost of his vessel, and the latter requires to know, at all times, the resources he can reckon upon as being contained in his bunkers. Admiral Paris has, therefore, been induced, by the results of his own practical observations, to substitute for the power marked by Watts's indicator in the above formula, the coal burnt, or, as he says, to substitute the cause for the effect; and he has established the formula $\frac{B^2\ V^2}{\text{coal}}$ upon which he calculated and tabulated, in figures, and graphically, the economical results of the steamers of the French Government, and of the Messageries Imperiales. The results so obtained convinced him that some other system must be adopted, in order to arrive at a correct view of the economical results obtained by the combustion of the coal; for a vessel is usually designed for the purpose of transport, and not exclusively for driving through the water as a plough passes through the land. It therefore becomes necessary to take into account the total weight of the vessel, hull, engine, and cargo, or, in other words, its displacement; and this has become of late the more necessary, because steam vessels, which were formerly built with lengths equal to 3¾ to 4 times their beam, are now built with lengths equal to 6 or 8 times that dimension. For reasons connected with that change of form, Admiral Paris adopted the system followed by the English Admiralty, and he took the displacement at the power of $\frac{2}{3}$, from whence to calculate an imaginary midship section adapted to the displacement.

Even in this mode of calculation, the dimensions of the vessel exercised too great an influence when the three modes of calculation were worked out; but Admiral Paris was still so thoroughly convinced of the importance of arriving at a correct solution of the problem he had undertaken, that he continued his researches. He then, with the intention of clearing the results of his investigations from the disturbing influences of the combustion, adopted the observations upon the results of the indicator grouped by M. le Bouleur, and he thereon observed that the curve passing through the mean positions proved that the useful effect of large vessels was double that of smaller ones, when calculated in the same manner. The appearance of this curve induced the Admiral to suspect that some means of correcting the error in the previous calculations must exist in the dimensions of the ship itself, and he therefore drew out the cross sections, which he found to increase in proportion to the useful effect. It followed that, by dividing the latter by the beam, he arrived at a number which was almost a constant, expressed by a straight line parallel to the ordinates; and he thus arrived at a general measure by taking $\frac{B^2 V^2}{P\ b}$, in which b is the beam, or maximum width of the ship.

This result, obtained from a great number of observations, made in nearly all the French ports, illustrated a very remarkable fact which had not hitherto been observed, viz., that the resistance of ships, instead of being in proportion to their midship section, (that is to say, to a surface,) was in proportion to that surface divided by a line, (that is to say, to a line,) and that of similar ships, but of different dimensions, the resistance would be in proportion to the beam. This property of large vessels may serve to explain the remarkable speed of some of the modern constructions, and it also proves the economical advantages of large vessels, when they are otherwise adapted to the commercial necessities of trade; for a vessel of double length, width, and depth, will carry eight times as much as a smaller one considered as unity in those respects, with only twice the expense, instead of with four times that expense, as hitherto was thought to be the case; or, for the same power per unity of surface at the midship section, it will employ less force. Thus the despatch-boat Ariel requires 377 horse power to produce the same useful effect as the Phlegeton produces with 31; the Imperatrice with 28; the Algesira with 26; and the Bretagne with 21—the Bretagne has double the length of the Ariel. In continuing these observations, it would be found that the Great Eastern would only require 15 horses, and that, if its screw propeller worked well, it ought to attain a velocity of 18 or 19 knotts; and that, moreover, a vessel of one tenth of the length of the Great Eastern would burn nearly a thousand times as much fuel to do the same amount of work, or, in other words, to carry the same load the same distance, and with the same velocity.

Admiral Paris observes that if the general measure thus pointed out be adapted to the required purpose when the force is ascertained directly by the indicator, it must also be adapted to that purpose when the combustible is alone considered. He therefore proposes, as a test of the relative economical advantages of a steam vessel, the formula $U = \frac{D^{\frac{2}{3}} \times V^3}{\text{coal} \times \text{beam}}$, and he drew up tables and diagrams founded upon it, and based upon observations made, not only in fine weather, but upon the average of the navigation. The first class of these observations were favourable to small vessels, which are generally long in proportion to their other dimensions; but the second are, on the average, identical, and are represented by a line parallel to the ordinates. It may, therefore, be considered that this line separates good ships from bad ones; and as the average result of navigation, on this mode of calculation, gives the result 6·2, any vessel which gives less must be considered to be an unsatisfactory one, whilst an observation of the curves will show that some vessels yield economical results which are seven times as advantageous as those of others. It is also to be remarked that the experiments give the result 7·2, which proves that in spite of the use of sails, a vessel at sea meets with more disadvantageous, than it does with favourable, chances; and especially that the hulls and the machines do not long remain in a good state. This last remark confirms the correctness of the practice of trade, which leads ship owners, who desire to insure a speed of 13 knots, to require a speed of 14 knots at first; and at the same time it proves how serious must be the cost to a company to ensure the speed and the regularity of its vessels.

Admiral Paris, in addition to this class of enquiry, has made some calculations with a view to ascertaining whether, in fact, the power exercised were proportionate to the cube of the velocity; and these calculations were made upon vessels of all sizes, with velocities of from 7 to 12 knots. He also observed how much coal had been burnt for each rate of speed, and by drawing the results in a curve, whose ordinates were the velocities, and whose abscissæ were the quantities of coal (in grammes). He introduced, upon the same drawing, a curve in the ratio of the cubes of the velocities, which were in their turn verified by comparison with the weights of coal required for their attainment. Moreover, different combinations of these experiments have proved the correctness of the facts observed; and similar calculations have shown that sailing vessels followed the same laws, insomuch as their useful result, from a given surface of sail, was also a nearly constant quantity represented by a straight line.

The majority of these ideas were published by the author in his work entitled, *Traite de l Helice Propulsive*, 1854. They have served as the basis of the system of premiums given by the Compagnie des Messageries Imperiales, to their captains and engineers. In 1857, the results of this system were rendered apparent, for an economy of £16,000 a-year was made upon the working of the previous average years, whilst the normal velocity of 9·2 knots an hour was retained; in 1858, the saving was £24,000; and in 1859, Admiral Paris considered that it would amount to £28,000, with the same velocity; but it is to be observed that this company has a fleet of 11,120 nominal horses-power, and that it performs a service of 917,580 marine miles per annum. It burns about 108,784 tons of coal per annum, which at the rate of £2 per ton, all charges included, make a total outlay of £217,568; so that the saving amounts nearly to 12 per cent. It appears that Admiral Paris submitted his views on this matter to the British Association for the Advancement of Science, and that he is surprised that no notice has hitherto been taken of them. Perhaps this translation may attract the attention of some of our readers, and induce them to favour us with further information on a subject of so much importance.

Plate. 270.

HORIZONTAL FEATHERING PROPELLER,

COL: ALEXANDER KYLE, *ABERDEEN.*

PATENTEE.

Fig. 1.

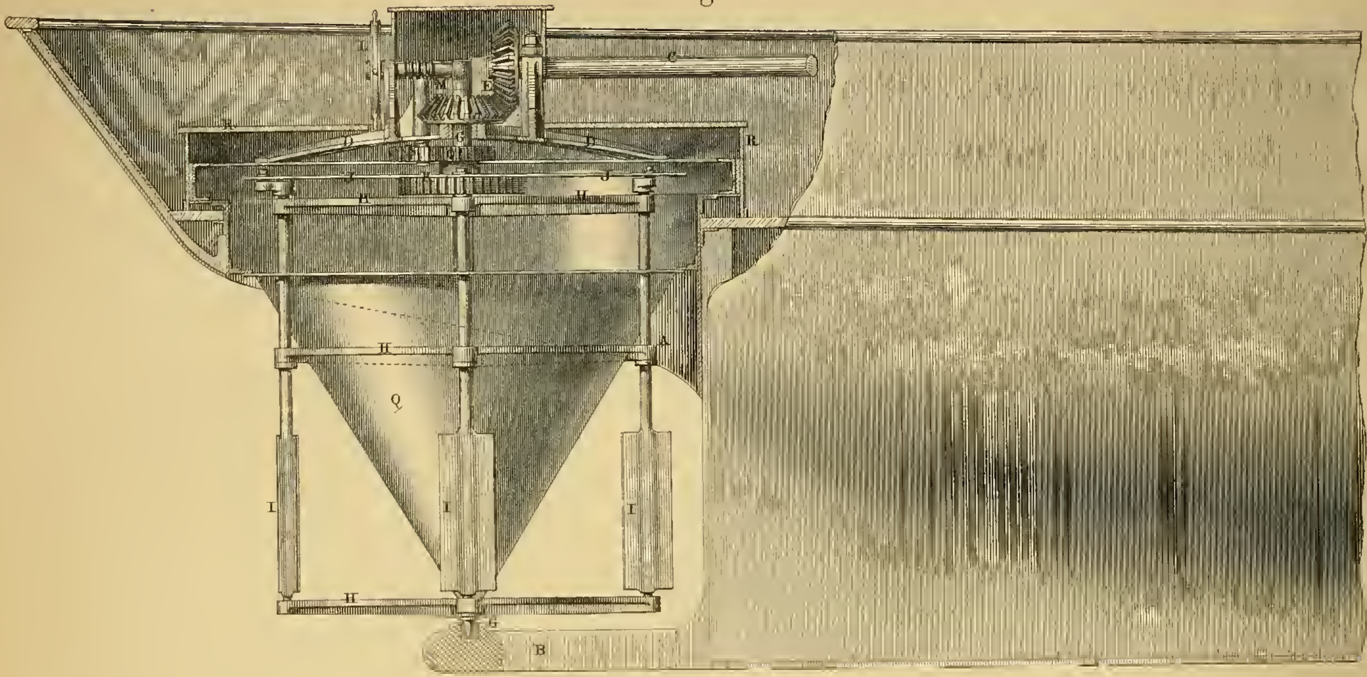
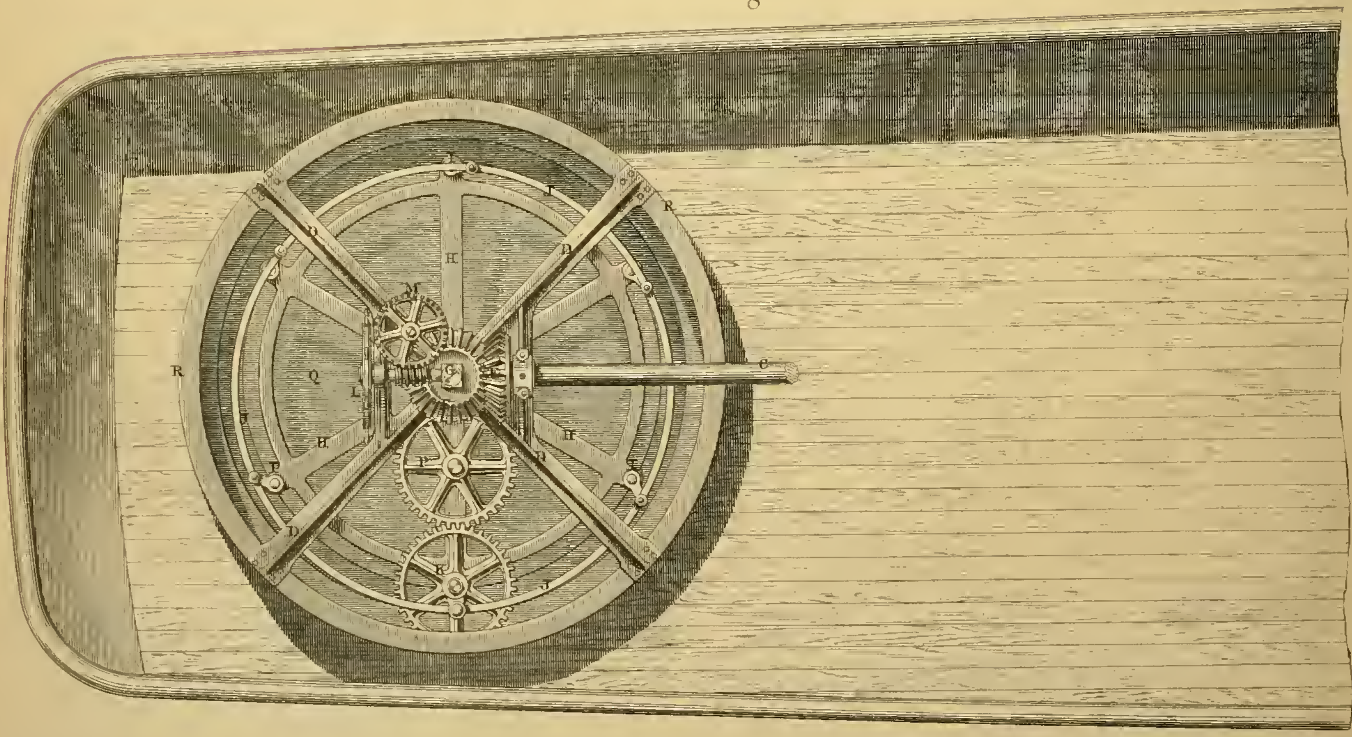


Fig. 2.



—SCALE.—

W. Johnson Patent Offices,
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UNITED STATES PATENT LAW.

We have great pleasure in informing our readers that the Legislature of the United States have at length passed an act to reduce the fees paid by foreigners upon patents to the same as those paid by American citizens.

The fees now to be charged are as under:—

	Dollars.
On filing each caveat, ...	10
On filing each application for a patent, ...	15
On issuing each original patent, ...	20
On appeal to the Commissioner of patents, ...	20
On application for re-issue, ...	30
On application for extension of patent, ...	50
On granting the extension, ...	50
On filing disclaimer, ...	10
On filing application for design 3½ years, ...	10
On filing application for design 7 years, ...	15
On filing application for design 14 years, ...	30

The law abolishes discrimination in fees required of foreigners, except in reference to such countries as discriminate against citizens of the United States; thus allowing English, French, Belgian, Austrian, Russian, Spanish, and all other foreigners, except the Canadians, to enjoy all the privileges of the American patent system (except in cases of designs), on the above terms. The entire cost to British subjects will, in future, be about £31 10s, in place of £130, as formerly.

No doubt many of our patentees will now extend their patents to the new field open to them.

HORIZONTAL FEATHERING PROPELLER.

By Col. Alexander Kyle, *Aberdeen.*

Illustrated by Plate 270.

The form of propeller introduced by Col. A. Kyle is about to be applied to an experimental vessel which was recently launched from Mr A. G. Cameron's yard at Greenock. The vessel is a handsome wooden clinker built steam yacht, 50 feet in length, 10 feet broad, and 5 feet in depth. In our illustrative plate, 270, we have shown one modification of Col. Kyle's improvements, applied as a stern propeller to a large-sized ship.

A circular opening or well, A, is formed at the after part of the vessel, an aperture of a suitable size is formed in the deck, and the frames which form the solid portion of the stern are cut away so as to leave a clear passage to the keel, B, which is prolonged to some extent beyond the centre of the well. Motion is communicated to the propeller from an engine arranged on deck, or in any other convenient position. The engine used in the vessel we refer to is one of the rotatory class, constructed according to Mr David Andrew's patent, a report and engraving of which we gave in the *Journal* for May, 1859. The engine gives motion to the driving shaft, C, the after end of which is carried in a pedestal bearing arranged on a cross-rail of the radial framing, D. On the end of the shaft, C, is keyed a bevel wheel, E, which gives motion to a corresponding wheel, F, on the upper end of the vertical shaft, G. This shaft is carried in footstep and collar bearings, the former arranged in the prolongation of the keel, B, and the latter in the framing, D. On the shaft, G, are keyed three radial frames, H, in the circular rims of which six eyes are formed, and through these pass the shafts of the vertical propellers, I. The propelling blades, I, turn freely in the rings H, and with the exception of one, each has fitted on its upper end a crank, the pin of which is connected to the ring J. Instead of a crank, one of the propeller shafts has keyed to it the wheel K, which is carried on a stud fixed in the arm of the upper ring H, the wheel is connected to the ring J, by an eccentric pin. The object of connecting the cranks of the propelling blades in this way, is to admit of their being simultaneously adjusted as regards their angular direction, so that the faces of the blades may be readily and instantly placed in any desired position. This is done by means of the hand-wheel, L, which is fast to a short worm shaft carried in a pedestal bearing, arranged opposite, and parallel to, that of the shaft, C. The worm gives motion to the wheel, M, which is fast to a spindle carrying at its lower extremity a second wheel, N, in gear with the wheel, O. This last wheel is duplex, being made with a deep tubular boss, and with a wheel on the lower end. This compound wheel is loose on the shaft, G, and the lower wheel is in gear with the intermediate wheel, P, which imparts motion to the wheel, K. With this arrangement, when the hand-wheel, M, is turned round, the partially rotatory movement of the wheel, K, which is connected by the crank-pin to the ring, J, imparts a corresponding amount of motion to the several cranks on the shafts of the propeller blades, so that they are simultaneously set at the required angle. This feathering action is accomplished, it will be observed, without interfering in any way with the rotatory movement of the propeller, as derived from the shaft, C, because the central shaft is running loosely within the boss of the duplex wheel, O. The cranks are so arranged that, when the vessel is moving ahead, the faces of the propeller blades, as they move round from the keel line to the port side, are successively brought into full action upon the water, so that they exert their whole force in driving it astern, but without disturbing it so as to cause broken water. From the central line of the propeller, taken athwart ship, the blades turn upon their axes, so that they gradually lose their hold upon the water, and they pass through it on the starboard side, with their vertical edges directed fore and aft, and thus offer little or no impediment to their passage in that direction. If now the steering-wheel be turned in either direction, it will have the effect of setting the propellers, I, at an angle either in advance of, or behind, the imaginary line taken across the propeller, and at right angles to the vessel's length. The effect of this is to cause the propellers to act upon the water in a diagonal direction, and so move the vessel's head either starboard or port, as may be required. Another arrangement of the submerged propellers consists in adapting them to vessels as side propellers, in place of the ordinary paddle-wheels. As soon as a trial of the vessel we have referred to takes place, we shall report progress.

BUNSEN & KIRCHHOFF'S SPECTRUM OBSERVATIONS.

The results of the investigations of Messrs Bunsen & Kirchhoff have already been communicated to the scientific public, at different times, by the *Philosophical Magazine* and other journals. On Friday, 1st March, an interesting lecture, embracing the whole subject, was given by Professor Roscoe at the Royal Institution, and we will now endeavour to lay a brief summary of the facts, as narrated by him, before our readers.

It has long been known that certain metallic oxides, and salts of the same, when placed in a flame, have the power of imparting colour to it. The reason of this is, that these bodies volatilize, and, at the temperature of the flame, their vapour becomes luminous. A substance that will not volatilize under the same circumstances gives no colour to the flame. Thus platinum becomes white-hot, but that is all. Chemists have availed themselves of the fact in order to discover the presence of these oxides. Thus, soda gives a yellow colour, potash a violet, lithium a bright crimson, barium a green, strontium a bright red, &c. Bunsen & Kirchhoff have examined these coloured flames by means of a prism, and the beautiful results which they have arrived at have originated a new and invaluable analytical process, whilst the discovery of certain phenomena to which the research led them may be said to mark a fresh era in science. When a ray of sun-light is passed through a prism, the well-known colours of the rainbow—the solar spectrum of Newton—are obtained, and the occurrence in the spectrum of certain dark spaces and lines, known, from their discoverer, as the "Franenhofer lines," may be observed. Now, if we examine the yellow light from a soda flame by means of a prism, we obtain a spectrum in which only one bright yellow space can be observed. In like manner a potash flame gives a spectrum in which certain reddish lines occur, and so on for each of the metals above named, each giving a particular and definite spectrum. Chemists are aware that the violet colour given to the flame by potash cannot be recognised, should even a small quantity of soda be present, as the yellow colour given by the latter renders the violet colour invisible. If, however, the mixed potash and soda flame be examined by means of a prism, the spectrum of each metal will be seen to be distinct, and confined to its particular sphere; and the same is observed in mixtures of the salts of all the metals above cited. The method by which this process is adapted to chemical analysis is thus given by Bunsen:—"A mixture of the chlorides of sodium, potassium, lithium, calcium, strontium, and barium, containing at most one ten-thousandth part of a grain of each of these salts, was brought into the flame, and the spectra produced observed. At first the bright yellow sodium line, N a α, appeared with a back ground formed by nearly a continuous pale spectrum. As soon as this line began to fade, the exactly defined bright red line of lithium, L i α, was seen, and still further removed from the sodium line the faint red potassium line, K α, was noticed, whilst the two barium lines, B a α, B a β, with their peculiar form, became visible in the proper position. As the potassium, sodium, lithium, and barium salts volatilised, their spectra became fainter and fainter, and their peculiar bands, one after the other, vanished, until, after the lapse of a few minutes, the C a α, C a β, S r α, S r β, S r γ, and S r δ, became gradually visible, and, like a dissolving view, at last attained their characteristic distinctness, colouring, and position, and then, after some time, became pale and disappeared entirely." Not more than half-a-minute is required for the performance of an analysis by this method. The delicacy of the process is extraordinary. Bunsen states that he can detect with it the $\frac{1}{180000000}$ part of a grain of soda, and the $\frac{1}{6000000}$ part of a grain of lithia. The latter substance has hitherto been considered to be but little diffused in nature, and only a few minerals were known in which it was present. Bunsen has now shown that it exists in almost all rocks, sea water, &c. Whilst examining the spectra of the alkalies obtained from some German mineral waters, Bunsen observed two new lines of bright blue colour. These he found resulted from the presence of new alkali-metal, which he named cresium, from *cœsius*, (the Latin for bluish-grey.) He has since discovered a second new alkali-metal (at present unnamed), which gives a spectrum of violet lines.

The most remarkable deductions arising out of this new method of investigation are those drawn by Kirchhoff, from his observations on comparing the spectra produced by the luminous vapours of metals with the solar spectrum, by which he proved that iron, magnesium, nickel, chromium, potassium, sodium, &c., exist in the sun, and in the sun's atmosphere. Kirchhoff found that the lines in the spectra obtained by the luminous vapour of some of the metals coincide exactly with certain dark spaces and lines in the solar spectrum, (those known as "Franenhofer's line,") and hence he concludes that each of the dark lines in the solar spectrum is caused by the presence, in the sun's atmosphere, of the luminous vapour of that metal which gives the coincident bright line. He observed that sodium vapour is absolutely opaque to the light which is emitted by a flame coloured yellow by soda. Kirchhoff's theory is, that there is in the sun a glowing gaseous atmosphere, surrounding a solid nucleus of possibly still higher temperature. "If we could see," he says, "the spectrum of the solar atmosphere without that of the solid nucleus, we should be able to see in it the bright lines characteristic of the metals which that atmosphere contains. The more intense luminosity of the internal nucleus does not, however, permit the spectrum of the solar atmosphere to become apparent; it is reversed, according to my newly-discovered proposition; so that, instead of bright lines, which the luminous atmosphere by itself would have shown, dark lines only appear. We do not see the spectrum of the solar atmosphere itself, but a negative image of it. By it we are, however, able to detect, in an equal degree of certainty, the metals present in the sun's atmosphere. All that we require for this purpose is a very accurate knowledge of the solar spectrum, and of the spectra of the individual metals." Dr Kirchhoff has proved that, in the spectra of some of the metals, the lines do not coincide with any of the lines of the solar spectrum, and therefore concludes that these metals, copper, silver, gold, lead, tin, &c., are not present in the solar atmosphere. Dr Kirchoff is still occupied in prosecuting his researches, and we may therefore hope for further discoveries in the vast new field which he and Bunsen have opened up.

MANUFACTURE OF ICE.

Monsieur Rezet, of Rouen, has lately constructed a machine of twelve horse power for manufacturing ice. When worked at eight horse power only, it is said to be capable of producing nearly three tons of ice per diem, at a cost price of less than 5d per cwt. The following is the process employed by the inventor:—

A fluid, ether, for example, is volatilized in a close vessel by exhausting the air on its surface by means of an air pump. The vapour engendered thereby is then exhausted and forced into another vessel, where, by its compression, and with the aid of cold water, its condensation takes place. When liquified, the ether is forced back into the first vessel, and the same operation is repeated as often as required. As volatilisation takes place in consequence of the continual absorption of the caloric contained in the surrounding bodies, and as the atmosphere does not supply this loss with sufficient rapidity on account of their being insulated, they fall to a very low temperature. If these bodies come in contact with pure water, they, in their turn, absorb a portion of the caloric contained in the water, and congelation takes place. The machine, independently of its motive power, consists of a double acting air pump, worked by an engine of eight or ten horse power. The pump has two outlet, and two inlet steam valves, of as large a diameter as the barrel will allow. They are adjusted with precision, and balanced so as to act under very slight pressure. In conjunction with this is an evaporating apparatus, which is exhausted by means of the pump. This apparatus is placed in a vertical position, and is composed of a series of tubes of small diameter, and about five feet in height, and presents an outside surface of about 250 square feet. These tubes rest on a tray of cast iron, and are surmounted by a hood or dome, into which the vaporized ether ascends. A condensing apparatus is employed similar in its form and proportions to the evaporating apparatus, but placed in a horizontal position in a cistern of cold water. The vaporized ether, which is forced into the condensing apparatus by the pump, liquifies as it parts with its caloric in passing through the tubes, which have a stream of cold water flowing around them. An arrangement of vessels called the "Regulator" is here required, through which the liquified ether from the condensing apparatus passes to the evaporating apparatus, with which it communicates by means of an aperture closed by a floating ball. When the ether has sufficiently accumulated to displace the ball by its pressure, the ball is borne upwards, and the ether passes under it; the ball then descends, and again closes the aperture until the next displacement. This regulator may be compared to the pulse; it shows by a visible movement each pulsation of the fluid; the number of its displacements vary with the velocity of the motive power; it indicates the quantity of ether liquified, and shows by its immobility when circulation is arrested in any part of the machine. Another part of the apparatus consists of a square wooden vat, of a capacity of twenty-seven cubic feet, in which are placed, side by side, ice-moulds made of tinned copper, and shaped like inverted cones. The circulation of the ether must be effected in close vessels, but the free circulation of another fluid of no intrinsic value may be added, and this will serve as a conducting medium. This fluid should be used freely, and may be composed of a solution of common salt, or any other substance which will prevent congelation. The evaporating apparatus is placed in a tank filled with this solution, which imparts all its caloric to the ether in passing through the large metallic partitions which compose the apparatus. This solution may be brought to a degree of cold so low as twelve or fifteen degrees below zero centigrade. On becoming cold again, it descends and circulates round the ice-moulds filled with cold water, which, in seeking to equalize its own temperature with that of the solution, imparts in the end all its caloric above zero centigrade to the solution until congelation is complete. The uncongelable fluid, when re-treated by this operation, returns to the evaporating apparatus in order to cool, and thus continuously circulates. Pipes and stop-cocks establish or intercept, as desired, the communication between the desired points, and pressure gauges are employed to indicate the amount of pressure. An air reservoir is fitted to the lower part of the condensing apparatus, in which all the air which may have entered the machine is collected. On turning a stop-cock, vent is given to the superfluous air. The liquified ether, or the vapours heavier than air, remain in the lower parts of the apparatus The excess of air in the regulator which, by its pressure, would obstruct the rising of the ball, is carried off by a pipe into this reservoir. All these operations are performed by the machine, except that of removing the blocks of ice and replacing them with cold water. In working the apparatus, the ether is placed in the evaporating apparatus, and the air exhausted by means of the pump, the atmospheric pressure being thus removed, the ether absorbs the caloric contained in the salt solution, which surrounds the evaporating apparatus, and instantaneously forms a vapour which fills the hood or dome; it then enters the pump and is forced into the condensing apparatus; there it becomes liquid, and its caloric is absorbed by the water which flows round the pipes of the condensing apparatus. This water being of a lower temperature than the compressed vaporized ether, absorbs through the numerous partitions of the condensing apparatus all the caloric which the ether in evaporating absorbed from the salt solution, as well as that engendered by the compression of the vapour itself. On leaving the condensing apparatus the liquified ether enters the regulator, which allows it to pass up into the evaporating apparatus, when a sufficient quantity has accumulated. The air pump being kept in contant action, the ether returns to the evaporating apparatus, evaporates a second time, condenses, and returns to recommence its circulation so long as the motive power continues to act, the same ether being used indefinitely. With regard to the saline solution, this, after having cooled in the evaporating apparatus, surrounds the ice-moulds, congeals the water they contain, and then, after having its temperature elevated by the absorption of the caloric contained in the ice-moulds, commences to cool again.

RECENT PATENTS.

STEAM ENGINES AND BOILERS.

Robert Bell, *Newcastle-upon-Tyne—Patent dated March* 22, 1860.

Mr Bell's improvements relate to the arrangement and construction of marine and other steam engines and boilers, and consists, as regards that part of the invention which relates to steam engines, in placing a small high-pressure cylinder concentrically within a large low-pressure cylinder, and working the two pistons in opposite directions, so that they may partially or wholly counterbalance each other, and thereby prevent any great inequality of strain upon the working parts, whilst at the same time a simple and economical mode of working high-pressure steam is obtained. The improvements in marine boilers consist in making their backs, tops, and fronts (above the smoke-box) of a semicircular or curved form, whereby greater strength is obtained, and many of the stays at present required are dispensed with. The interior of the boiler and its furnaces is so arranged that the flame or heated gases, after passing from the furnaces to the back of the boiler, return between rows of vertical tubes filled with water, to the front, and then pass through another series of vertical tubes, the lower ends of which are covered with water, and the upper portions passing through steam, so that the latter will become, to a certain extent, superheated.

Fig. 1, of the accompanying engravings, represents a longitudinal vertical section of one modification, arranged according to this invention, of an improved combined high and low-pressure steam engine as designed for driving a screw propeller shaft of steamships, and having inverted cylinders. A small high-pressure cylinder, A, is placed concentrically within the large low-pressure cylinder, B, the respective pistons of the two cylinders being made to travel in opposite directions, by placing their relative cranks, C and D, on diametrically opposite sides of the crank shaft, E, as shown, by which arrangement the two pistons will wholly or partially counterbalance each other, and consequently, any irregularity in the strain upon the working parts of the engine is obviated. The piston, F, of the high-pressure cylinder may be of the ordinary construction, provided with one or more piston rods, G, and connecting rod or rods, H, attached to the central crank, C. The piston, I, of the low-pressure cylinder, B, is of an annular form, being packed to work steam-tight against the exterior of the high-pressure cylinders and the interior of the low-pressure cylinder; it is attached to two piston rods, K, which are connected by suitable connecting rods not shown, to the two cranks, D, respectively. When two or more pairs of cylinders are used, the patentee makes the cranks of the high and low-pressure cylinder in each pair, diametrically opposite to one another, as above stated; but when only one pair of cylinders is used, he prefers to place the respective cranks at an angle of about 178 deg. or less, with each other, in order to prevent the pistons and connecting rods of the two cylinders ever being in a direct line with the centre of the crank shaft at the same time, whereby the starting of the engine is greatly facilitated. A peculiarly constructed slide valve is employed for distributing the steam entirely by the aid of one single slide valve, so as to admit the steam to the high-pressure cylinder, transmit it thence to the low-pressure cylinder, and finally from the low-pressure cylinder to the condenser. *a*, are the steam ports of the high-pressure cylinder, which are only one-half the width of the ports, *b*, of the low-pressure cylinder; L, is the main slide valve, in the interior of which are formed the two steam passages, *c*, sufficient space being left at *d*, round such passages, for the free exhaust of the steam, as will be clearly seen on reference to the position of the valve in the fig., which shows the valves in sectional elevation as full open; the high pressure steam is here shown as entering the upper end of the high-pressure cylinder, and exhausting into the lower end of the low-pressure cylinder, whilst the final exhaust of the steam from the upper part of the low-pressure cylinder is simultaneously taking place through the exhaust passages, *e*. As in other engines when the slide valve is at half-stroke, the whole of these steam and exhaust ports are closed. The expansion slide valves are shown at M, as working on the back of the main slide; it is worked by two rods passing one on each side of the main slide valve and rod, and connected by a cross head outside the casing, which is worked by a single eccentric and link, or other valve motion, which it has not been considered necessary to illustrate. Fig. 2 represents a longitudinal vertical section of the patentee's improved form of steam boiler; and fig. 3 is a corresponding sectional plan of the same, corresponding to fig. 2. The shell of this boiler is made semicircular or of a curved form at the back, front, and top, as shown at A, B, and C, respectively; these semicircular sections are connected to each other by angle iron, as shown at *a*. By making the surfaces of the boiler semicircular or curved in lieu of flat, greater strength is obtained and fewer stays required. D, is the furnace chamber, the fire-bars of which are not shown, and E, are a number of vertical water tubes placed in the flue, F, and opening into the body of the boiler above and below that flue, so as to produce a free circulation of the water in the boiler. The flames and gases after playing round the tubes enter the series of vertical tubes, G, through which they pass to the chimney. As these tubes, G, are only surrounded with water at their lower ends, whilst the greater portion of their length is contained in the steam space of the boiler, it follows that a considerable degree of heat will be imparted to the steam, which thereby becomes a certain extent superheated in the boiler.

Fig. 1.

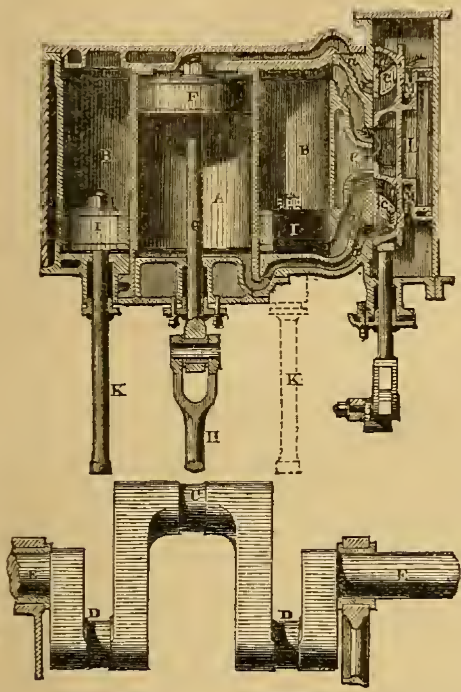
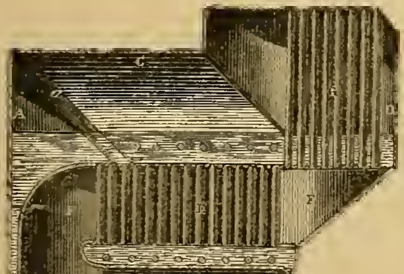


Fig. 2



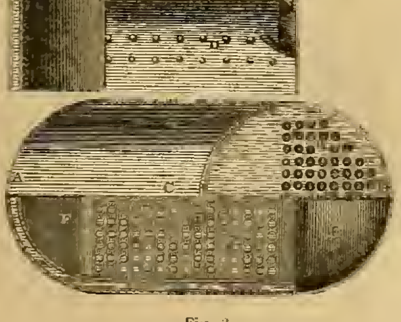


Fig. 3.

WASHING TEXTILE FABRICS AND MATERIALS.

James Fleming, Jun., *Glasgow—Patent dated Aug.* 24, 1860.

The patentee's improvements relate to the arrangement and construction of machinery or apparatus for effecting the operation of washing, cleansing, and preparing textile fabrics or materials in a more efficient manner than is accomplished with the ordinary apparatus.

Fig. 1, of the accompanying engravings, is an elevation partially in section of one modification of the improved washing apparatus; fig. 2, is an end view of the same. The framing of the machine consists of two end standards, A, which are arched at the lower part, and spring from a rectangular base or sole plate. The standards, A. are connected at the base by a longitudinal rib, or central plate, in which is cast the footstep, B, to receive the lower end of the main shaft. The upper ends of the standards are connected by the transverse beam, C, which is supported by, and bolted to, the inwardly projecting brackets cast on the standards. The main shaft, D, is arranged in a vertical position in the centre of the machine; it is carried in the footstep and collar bearings, B and E. This shaft is cast hollow, but closed at the lower end. Rotatory motion is communicated to the shaft from the engine or other prime mover, by means of a horizontal shaft, carrying at its extremity a pinion, F, in gear with the spur-wheel, G. This wheel is fast to the shaft, D, and so also is the deep tubular boss, H, of the washing-trough, I; so that on motion being communicated to the pinion, the shaft, D, the wheel, G, and trough, I, are

Fig. 1.

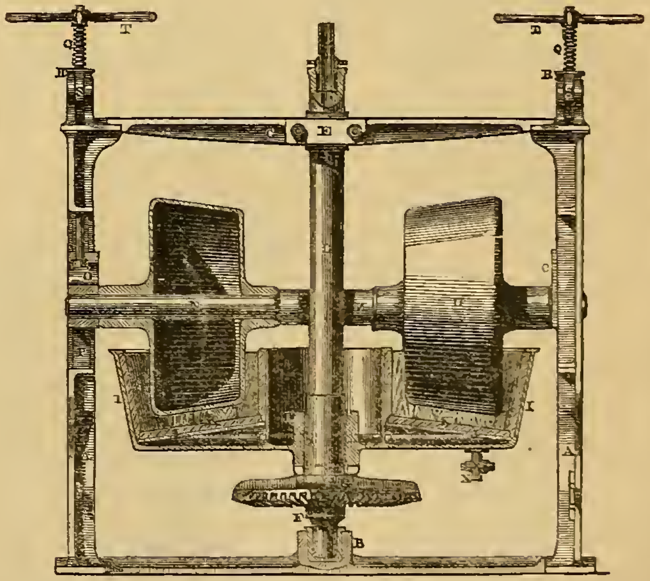
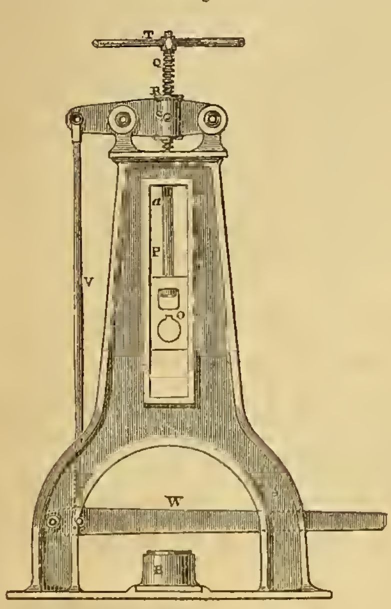


Fig. 2.



caused to rotate. The trough, I, is formed of cast-iron; it is of an annular figure, and rather wider at the top than at the bottom. Flanges are cast on the inside of the trough to admit of a sloping false-bottom, J, resting thereon. The trough, I, is fitted with a wooden lining, K; and the false-bottom, J, as well as the lining, K, are perforated to admit of steam passing up from the space below the bottom, J, and into the trough. The upper extremity of the shaft, D, is fitted with a gland and steam-pipe, L. The steam, obtained from any convenient source of supply, passes down the shaft, D, and through the lateral steam-pipes, M. About half the length of these pipes are screwed externally; they are passed through apertures formed for the purpose in the inner ring of the trough I, to which they are secured by jam nuts. The screwed ends of the pipes, M, pass through the boss H, and into the shaft, D. The inner ends of the pipes, M, are closed; but the whole length of the pipes beyond the inner ring of the trough is perforated. The trough, I, is partially filled with water, or a chemical solution; and the fabrics or materials to be cleansed are placed therein, and upon steam being admitted to the shaft, D, it passes through the pipes, M, and causes the water, or solution, to boil. In addition to this, the goods are subjected to a pressing and squeezing operation by means of rollers, which greatly facilitates the cleansing process. Extending across the machine is a hollow shaft, N, which is formed with a curve in the centre so to clear the shaft, D. The extremities of the horizontal shaft, N, are carried in adjustable bearings, O, which are arranged in the slots, P, of the standards, A. The bearings, O, move up and down in grooves formed in the inner faces of each slot; and the bearings are raised or lowered by means of the screws, Q, which are attached thereto. The screws, Q, pass out through the nuts, R, which are formed with laterally projecting pins that are supported in the levers, S. This arrangement is to admit of the depression or elevation of the levers without affecting the screws, Q. The upper ends of the screws, Q, have fitted to them the cross heads, T, by means of which the shaft, N, and its connected parts are raised to admit of the removal of the goods from the trough, I. The shaft, N, carries loosely upon it two hollow iron rollers, U, the weight of which squeezes out the water or washing solution as they pass over them. The alternate squeezing out of the fluid, and its re-absorption into the fibres of the goods, speedily effects the complete cleansing of the same. The bushes in the bearings, O, are made sufficiently deep to admit of the rollers rising upwards as they pass over the goods; on the other hand, if increased pressure is required, the screws, Q, are lowered until the ends rest on the journals of the shaft, N. The arrangement of the levers, S, also secures a greater or lesser amount of continuous pressure. Each of the levers is connected by a link, V, to the lever, W, which is centred upon a stud projecting from the inner face of the standard, A. By means of counterweights placed on the levers, W, the rollers, U, may be caused to press with more or less force on the goods in the trough, I. The water or washing liquor is drawn off from time to time by means of the cock, X. The rollers, U, may, if preferred, be covered with wood, so that no metal surface is brought into contact with the goods contained in the trough. The uncovered rollers may also be heated by steam, which is conveyed into the interior of each roller through the shaft, N. Another modification of these improvements consists in arranging the rollers, U, so that motion is imparted to them instead of the trough, I. This may be done by means of a bevel spur-wheel keyed to the shaft, D, and gearing, with two bevel-wheels, one arranged on the end of each roller, U. The rotatory motion of the rollers, as they press on the goods in the trough, will cause it to revolve in the same manner as the rollers, U, rotate on the shaft, N, by the frictional contact of the goods against their peripheries. The result of these combined motions is that the goods or materials are boiled and washed or cleansed in a superior manner, and without injury to the finest class of fabrics or materials, which is a point of great importance in treating muslins, for which class of goods this machinery or apparatus is more especially designed.

HEMP AND FLAX DRESSING MACHINERY.

James Ireland, *Lille, France—Patent dated July* 28, 1860.

This invention relates to a peculiar construction and arrangement of machinery or apparatus for opening and drawing hemp, flax, tow, and other fibrous substances of a like nature, and consists in the employment of an endless travelling band or apron, upon which the fibrous substances are first laid and spread by hand. This apron conveys the material between a pair of feed rollers, which conduct it to the first pair of a series of "porcupine," or toothed opening and drawing rollers. Each pair of the series rotates at a speed slightly increased beyond the preceding pair, so as to draw out the fibres, and form a sliver or sheet, the teeth, which are slightly inclined on the rollers, being arranged in rings, which intersect each other, and thus draw out the fibre without breaking or injuring it in any way. From the last pair of opening and drawing rollers the lap or sheet passes between a drawing roller and a pressing roller, which rollers draw out and consolidate it, and finally deliver it to a pair of delivery rollers, whence it passes in the form of a lap or sheet into a box or receptacle beneath, or on to the roller of a lap machine. When a receptacle is used, it has a to-and-fro motion imparted to it to admit of the lap or sheet being laid in a zigzag form in the bottom. The lap or sheet so formed may be either submitted in the process of the manufacture to the finishing card or to the ordinary drawing frame. If found desirable, a pair of drawing rollers may be introduced between each pair of "porcupine" rollers, for the purpose of preventing the sheet from being overdrawn or weakened at any point.

Fig. 1.

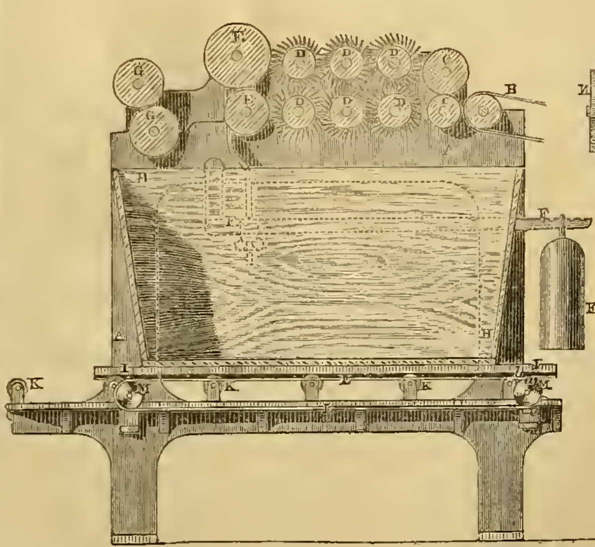


Fig. 2.

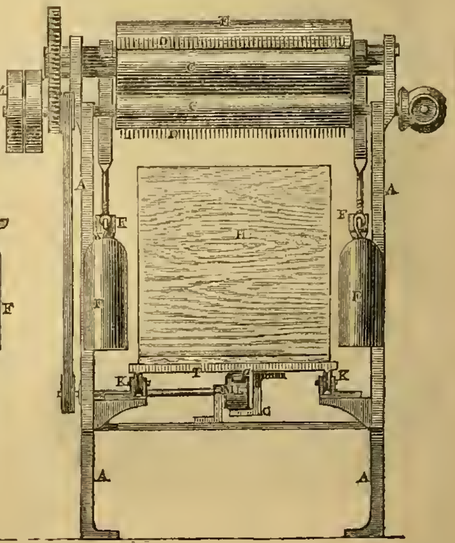


Fig. 1 of the accompanying engravings represents a longitudinal vertical section of this improved machine, and figure 2 is an end elevation of the same, corresponding to figure 1. The main framing of the machine consists of two cast-iron side frames, A, having transverse stays to keep them at a proper distance asunder. At the front end of the machine is arranged an endless feeding band, B, supplying the fibrous material to the pair of feed rollers, C, which conduct to the first of the series of "porcupine" drawing rollers, D. Between these rollers it passes on its way to the pair of drawing rollers E, the upper roller acting as a pressure for consolidating the lap or sheet; the roller is held down by the pair of weighted levers, F. The lap or sheet, on leaving these last mentioned rollers, is received between the delivering rollers, G, which finally deliver the sheet into a receptacle, H, or on to a lap machine. When a box is used, the patentee prefers to mount it upon a reciprocating table or platform, as shown at I, mounted on rollers, K, along or over which it travels to and fro. This reciprocating motion is derived from the endless band, L, carried by the two pullies, M, and provided with a projection or stud, *a*, which acts alternately upon the projections *b* and *c*, fixed to the underside of the table, and consequently imparts a to-and-fro motion thereto. The machine may be driven from a pair of ordinary fast and loose driving pullies, N, and motion transmitted to the lower set of rollers and "porcupines" by level gearing, as shown in figure 2, suitably proportioned to impart the desired speed to the several rollers. The upper series of rollers and "porcupines" may be driven from the lower set by spur wheels, or other convenient mechanical contrivance; but these arrangements for driving the machine form no part, separately, of the patentee's invention, and may be varied more or less.

COLOURS—EMERALDINE AND AZURINE.

CALVERT, LOWE, AND CLIFT.—*Patent dated June* 11, 1860.

MANY as have been the processes which have been devised for the production of beautiful colouring matters from aniline, the resources of chemists do not yet appear to be exhausted. This patent has been obtained by Professor Calvert, Mr Lowe, and Mr Clift, of Manchester, for the production of two new colouring matters from aniline, or its analogues. The novelty of this invention is, *firstly*, that the colouring matter is produced directly in contact with the fibre or fabric to be coloured, and *secondly*, in the transformation of the colour so produced, which, being of a green colour, is called emeraldine, into a blue colouring matter, which is called azurine.

To prepare emeraldine, the yarn, fibre, tissue, or fabric to be coloured, is impregnated with an oxydising agent. By preference, with a solution of chlorate of potash, of about four ounces of chlorate to the gallon of water; it is then dried and padded, printed with an acid salt of aniline, toluidine, xylidine, or cumidine mixed with water. A salt of aniline is preferred, because it is easily obtained, and because the colour produced is, perhaps, superior to that produced by any of its analogues; and for a full shade, a solution of tartarate or chloride of aniline, containing about one per cent. of aniline is employed. After padding or printing, the goods must be allowed to age for twelve hours, by which time the colour will be completely developed. Emeraldine is likewise produced by padding or printing the yarn, fibre, tissue, or fabric, with a solution of a salt of aniline, toluidine, xylidine, or cumidine. We prefer a salt of aniline, selecting a tartarate or a chloride, by preference, and mix it with an oxydising agent. The use of chlorate of potash, thickened with starch or flour paste being preferred, the proportions of the mixture found most convenient for a full shade of colour are the following, although they may be slightly varied without any appreciable results—solution of an acid salt of aniline (containing 1 lb. of aniline); tartarate, or chloride of, 3 lbs.; starch, or flour paste, 60 lbs.; chlorate of potash, 1 lb. The chlorate of potash must be dissolved in the starch paste whilst hot, and the solution of the acid salt of aniline, we add to it after cooling. An acid salt of toluidine, xylidine, or cumidine may be used in the place of the acid salts of aniline above named, but the above salts are preferred, as being at present cheaper and more easily obtainable, as well as producing a better colour.

To convert the green colour, obtained as above-described, into azurine of a blue or purple shade, the goods must be boiled in a weak alkaline or soap solution, and dried. One ounce of alkali, choosing caustic soda, to a gallon of water, or four ounces of printer's soap, to one gallon of water; or the goods may be passed into a weak solution of chromate or bichromate of potash previously to being washed off. It has been found that a solution of one ounce of bichromate of potash in a gallon of water, answers the purpose well. Other alkalies, alkaline salts, or oxydising agents may be substituted for the chromate or bichromate of potash above named, but by their employment the azurine is obtained of a more permanent nature by their use. The colours above produced do not require the intervention of an albuminous, or other mordant, to cause them to adhere to the yarn, fibre, tissue, or fabric.

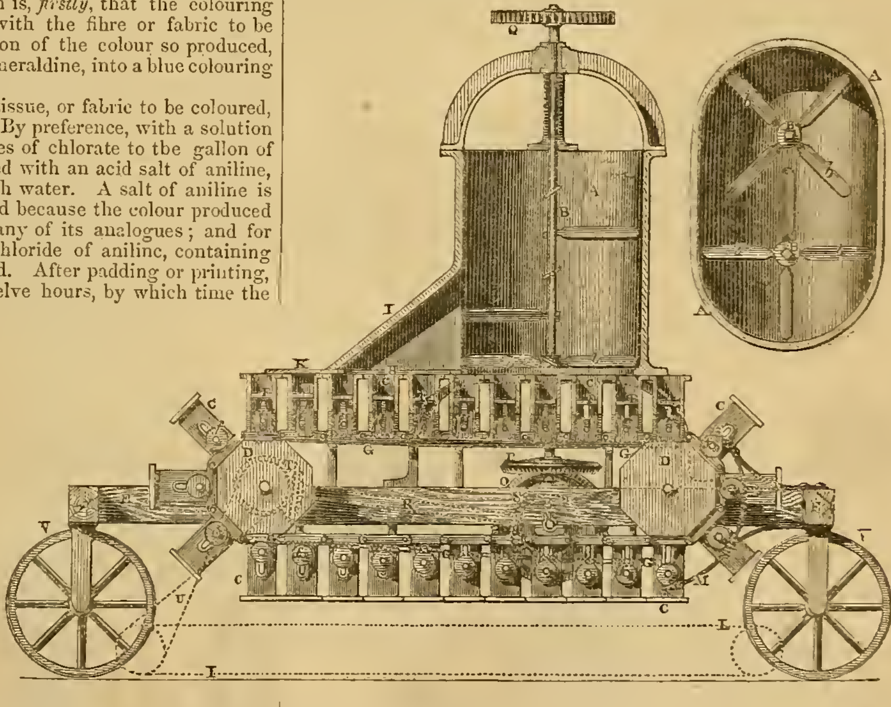
BRICK MAKING MACHINE.

HENRY WIMBALL, *Aldermaston, in the county of Berks, Brick Manufacturer—Patent dated 20th June*, 1860.

UNDER these letters patent, a peculiar construction and arrangement of machinery or apparatus for making bricks and other similar articles, in a continuous manner, direct from the pugmill, or otherwise, is specified, and consists in the employment of an endless chain of moulds, each mould being considerably deeper than the thickness of the brick, and provided with a pressing piston, operated upon by rollers working up inclines as the chain moves along. This endless chain passes beneath a pugmill, and it is preferred to use the peculiar pugmill for which Henry Wimball obtained letters patent on or about the 19th of October, 1857. No. 2672.

Fig. 1, of the accompanying engraving, represents a longitudinal section of the patentee's improved brick making machine. The pugmill, A, is provided with two shafts and sets of knives, B; these knives are made to cross or intersect each other as they rotate, as shown in fig. 2, at right angles to fig. 1, which is a sectional plan of the pugmill detached. An opening is made in the bottom of the pugmill, under which the several moulds, C, are made to travel and receive each a charge of clay, such clay being forced through the opening in the bottom of the pugmill, by the bottom or lowest series of knives, *b*, which are preferred to be placed in the same horizontal plane. Each mould is jointed to its neighbour, so that the entire series forms an endless chain of moulds. This endless chain is carried by the two flat-sided drums, D, carried in bearings on the main framing, E. Each mould contains a moveable piston or plunger, F, to which are connected antifriction rollers, one on each side of the mould on the outside thereof, the axle of the rollers passing through a slot, as shown in fig. 1, in the sides of the lower part of the mould, so that a free vertical play may be given to the axle along the slots, and so admit of the piston rising and falling in the mould when the rollers are forced up or down. This movement of the pistons is effected by causing these rollers to run along suitable inclined rails, G, placed one on each side the series of moulds. As the endless chain is moved along, the rollers of the upper set of moulds travel along the surface of the inclined rails, G, one of which only is seen in the lower part of fig. 1, as forcing the pistons towards the outer surface of the moulds. The rails may be level at upper part, immediately below the opening in the bottom of the pugmill, so that the moulds may be filled with clay whilst the pistons remain

Fig. 1. Fig. 2.



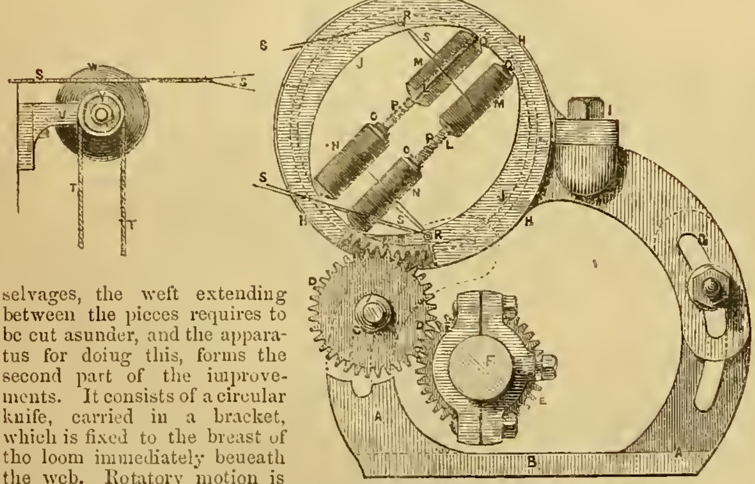
stationary at the lower part of the mould; but as the moulds pass under the fixed grating, H, the rollers pass along an inclined portion of the rails which raises them gradually, and forces up the pistons and squeezes the superfluous clay back into the front part, I, of the pugmill through the grating, at the same time expelling the air from the mould. From the grating, the moulds pass under the plate, K, and as the pistons continue to rise, the clay is compressed by the pistons against the under side of the plate until the mass attains the desired thickness for a brick. The moulds then leave the plate, K, and return to the opposite end of the machine in an inverted position, as shown in fig. 1. The compressed bricks are expelled from the moulds by the continued and further action of the pistons, the rollers of which pass along the lower set of inclined rails, O, and force out the bricks on to an endless travelling band, L, which carries them away. The pistons are forced down again to the bottoms of the moulds in readiness to receive a fresh charge of clay by the action of the curved rail, M, upon the rollers as they pass inside it. It is obvious that a single central roller might be used in each mould, acted upon by a single central inclined rail, in lieu of fitting two rollers to each mould, and using two rails. The pugmill shafts are driven from the main driving shaft, N, on which is keyed the bevel wheel, O, gearing into the corresponding bevel wheel, P, fast on the lower end of one of the two shafts of the pugmill, motion being transmitted from such shaft to the second shaft of the mill, by spur wheels, Q, at the upper ends of such shafts. R, is a counter shaft, which receives motion from the main shaft through the mitre wheels, S, and transmits such motion by another pair of mitre wheels, T, to the drum, D, which thereby gives motion to the endless chain of moulds. U, is a belt or strap for imparting motion to the endless travelling band, L. The entire machine may be mounted on running wheels, V, if preferred, for the convenience of transport, and the pugmill which, in the engravings, is shown as being supported by cast iron arched brackets, may, if desired, be dispensed with entirely, the clay being forced by hand, or in any other manner, into the moulds before they pass under the fixed grating or plate. Perforated pressed bushes may be made in this machine, by using a second plunger in each mould, provided with perforators or pins, which pins pass through and slide independently of the first mentioned piston, and are actuated by a separate inclined surface.

APPARATUS FOR WEAVING.

William Holms and Jabez Oldfield, *Glasgow—Patent dated August* 15, 1860.

These improvements are designed to facilitate the simultaneous production of two pieces of fabric in one loom. The first part has reference to a mechanical arrangement for forming the inner and contiguous selvages of two pieces of cloth woven simultaneously. After the formation of the selvages, the weft extending between the pieces requires to be cut asunder, and the apparatus for doing this, forms the second part of the improvements. It consists of a circular knife, carried in a bracket, which is fixed to the breast of the loom immediately beneath the web. Rotatory motion is imparted to this cutter by means of pulleys, or other convenient means, driven from one of the shafts of the loom. In lieu of a rotatory cutter, a bevelled, or wedge, or other shaped, cutter or cutters may be arranged to sever the weft, to which either a horizontal, reciprocatory, or other movement is imparted in any convenient manner.

Fig. 1.



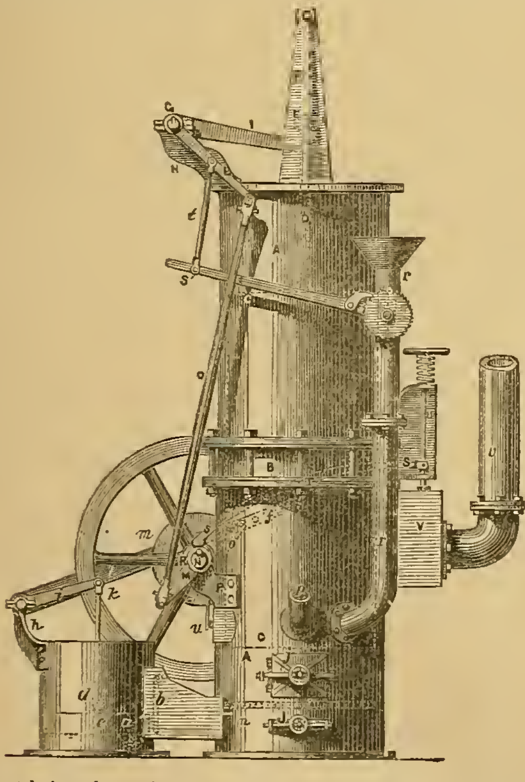
The accompanying engraving, is a partially sectional elevation of one arrangement of the machinery or apparatus for forming the contiguous selvages of two or more widths of fabrics, and for cutting the woven fabrics asunder prior to their being wound upon the cloth beam. At the back part of the loom, the framing has bolted to it a vertical stay to which the selvage forming apparatus is attached. This stay or supporting piece has bolted to it an adjustable laterally projecting bracket, in which is a slot to receive the stud which connects the selvage apparatus to this bracket, the slot affording the means of adjusting the apparatus centrally, as regards the warp of the pieces to be woven. To the bracket just referred to, is attached the curved bracket, A, which has a slot, B, formed in the sole part, to admit of the adjustment of the apparatus in a direction at right angles to the supporting bracket. In this way, the whole of the movement may be adjusted laterally, or in a direction parallel with the warp. The ends of the bracket, A, are curved inwards, and both are slotted; in the front end the slot, C, has fitted to it a stud, which carries the pinion, D; this pinion is driven by a corresponding pinion, E, on the crank shaft, F. In the slot, G, of the bracket, A, is a bolt, by means of which is attached thereto a circular metal strap, H, which is formed in two parts that are connected together by a screw at I, or these parts may, if preferred, be hinged together. This strap overhangs the pinion, D, and by means of the bolt working in the slot, G, the strap and the mechanism which it carries may be adjusted vertically. The strap has arranged within it a brass ring, J, which moves freely; the periphery of this ring is formed with flanges, and a portion of the space between the flanges is encircled by the stap, H. The other portion of the periphery of the ring, J, forms a small spur wheel, K, which gears with the pinion, D, the slots, C and G, affording the means of adjusting the wheel and pinion up or down as required. The ring, J, is made with an elliptical opening, in which are arranged, parallel to each other, and in the longer axis of the ellipse, two spindles, L, the extremities of which run in holes formed in the inner rim of the ring. Both the spindles, L, are arranged in the same plane, and each carries two bobbins, M and N. Between the bobbin which is first put on to the spindle, and the second one, there is interposed a shoulder, O, which is fast to the spindle and a helical spring, P, the pressure of which, against the end of the second bobbin is regulated by a small pin, which is passed through one of the holes, Q, in the ends of the spindles. Just beyond the shoulder, O, the spindle has inserted in it a small pin, the projecting part of which passes into a corresponding notch formed in the end of the bobbin, which is arranged on that portion of the spindle. The holes, Q, in the end of the spindle are made at right angles to one another, and if the pressure of the bobbin on the spring, P, requires to be increased, a pin is inserted in a hole nearer to the end of the bobbin. The removal of the pin admits of the spindle being slipped downwards into the hole in the ring, J, and the upper end can then be passed outwards, clear of the ring. In filling the four bobbins, M and N, with cotton, or other material, they are wound in contrary directions, or in a manner corresponding to the convolutious of a right and left-handed screw. The bobbins are arranged on the spindles in the same manner, that is to say, the drawing off of the respective threads from one pair of bobbins, M or N, will cause one bobbin to turn to the right and the other to the left, and so avoid any slackness of the threads. The threads from each pair of bobbins are carried through the holes, R, in the ring, J; there are two of these holes in each face of the ring, through which the four threads are passed. The two threads from each pair of bobbins, after being passed through the holes, R, are carried forward to the front of the loom with the warp, and are attached to the cloth beam. When the loom is put in motion, the crank shaft, F, causes the ring, J, carrying the bobbins, M and N, to rotate, but at a slower speed—that is to say, the ring, J, makes but half a revolution to one revolution of the crank shaft. The effect of this arrangement is, that at each revolution of the crank shaft, the threads, S, proceeding from each pair of bobbins, M and N, are caused to cross each other, and in manner similar to the shedding action of the warp, which is arranged to form the separate and contiguous pieces of cloth. When the threads, S, are crossed by the partial revolution of the ring, J, they form a portion of the shed through which the weft passes, the next half revolution of the ring continues the crossing or twisting of the threads from the bobbins, M and N, and so binds in the weft. In this way, a regular and uniform selvage is formed on each piece of cloth, and from the particular arrangement of the mechanism, it occupies so small a space in the centre of the warp, as not to interfere in any way with it. As the weft passes right across the warp, and between both the compound selvage threads, S, it is necessary to cut this weft asunder, to separate the two pieces of cloth. It is preferred to effect this severance of the pieces by the arrangement of a rotatory cutter, as shown to the front, or left, of the accompanying figure. The endless band, T, derives its motion from a pulley arranged at the lower part of the loom, this pulley is driven in any convenient way from the tappet shaft, or other suitable part of the loom. A small bracket, U, is bolted to the inside of the breast beam, this bracket carries the pulley, V, round which the band, T, passes and gives motion to the circular cutter, W. As the cloth is drawn over the breast beam by the take-up motion, the continuous rotatory movement of the cutter, W, severs the weft threads as they are successively brought up to it, and the two or more pieces of cloth are wound separately on to the cloth beam. This arrangement of the rotatory cutter is much superior in its action to a stationary blade, as the motion of the cutter tends to sever the weft in an even and more efficient manner, without the tearing asunder which characterises the severance when effected by means of a stationary blade. In lieu of a rotatory cutter, a clean cut may be obtained by means of a wedge-shaped cutter, or any other suitable figure may be given to the cutter, to which a horizontal, or other reciprocatory movement, is imparted by means of a cam, or other convenient contrivance, actuated from either of the ordinary movements of the loom. With these improvements, the manufacture of two or more pieces of cloth in a single loom is facilitated, and the appearance of the selvages formed and cut by this mechanism is greatly improved.

HOT-AIR ENGINE.

J. H. JOHNSON, *London and Glasgow* (MILTON A. WHIPPLE, *of Boston, U.S.*) —*Patent dated April* 17, 1860.

THE said invention relates to a peculiar construction and arrangement of caloric or hot-air engine, and consists of the following combination and arrangement of the various working parts:—

The accompanying engraving represents a side elevation of one modification of this improved caloric or hot-air engine, as arranged according to this invention. A represents the main working cylinder, composed of cast iron, but having an intermediate part, B, of much thinner material inserted about its middle, and secured to the upper and lower portions of the cylinder by bolts passed through the flanges formed on the intermediate part, B, and upon the junction edges of the upper and lower portions of the cylinder. In the interior of this parallel cylinder, A, there works freely a piston, C, shown in dotted lines, which is packed at its upper end only, that being the coolest portion. This piston is made of copper, and is hollow, being enclosed or covered in at the top and bottom, and is capable of descending to within, say, six inches of the fuel in the grate, presently referred to. The piston rod, D, which works freely out through the end of the cylinder, is secured at its upper end to the cross head, E, working vertically in the upright guides, F, bolted to the top of the main cylinder. G, is a rocking shaft, working in bearings in the brackets, H, also bolted to the top of the cylinder. This shaft carries a lever arm, I, connected at its free end by a short link, K, to the cross head, E. A second lever arm, L, is also fixed on to the end of the rocker shaft, G, and this lever, L, is connected to the crank, M, on the main working shaft, N, by the connecting rod, O. One crank only is shown in this arrangement, but, if preferred, two such cranks, with their connections, may be employed, placed one on each side of the engine. The main shaft, N, works in bearings, carried by a pair of brackets, P, bolted to the side of the lower portion of the working cylinder, and is provided with a fly wheel Q. R is a cam, shown in dotted lines, which is also fitted on to the crank-shaft, N, and actuates the bent lever, S, working on a fixed centre at T. To the free end of this lever is connected the spindle U, which is attached to a blow-off or escape valve contained within the box or chamber, V. A helical spring, with a regulating screw and hand wheel, serve to adjust the position of the blow-off or escape valve. A rectilinear motion is given to the piston or plunger, *c*, of the air pump from the circular motion of the crank-shaft, just in the converse way that circular motion was given to that shaft from the rectilinear motion of the piston, C, of the caloric cylinder, A. Thus the disc, *m*, fast on the other end of the crank-shaft, N, to that of the crank, M, has a projecting pin which, through the short connecting rod, *o*, gives a vibratory motion to the lever, *l*, fast on the rocking shaft, *g*, which, through the lever, *i*, and link or rod, *k d*, actuates the piston, *c*, of the pump for forcing the air into the furnace at the lower part of the engine cylinder. Greater or less motion can be given to this pump by connecting the rod, *o*, to one or other of the holes, *f*, in the lever, *l*. The ascent of the piston, *c*, causes the cold air to rush in through the valve, *a*, and thus fill the pump, while the descent of the piston, *c*, forces the cold air through the valve, *b*, shown in dotted lines, into the valve-box and passage, which conducts the air thus forced into the ash-pit, *n*, of the furnace. J, *j*, represent respectively the ash-pit and fire-doors, which are kept tightly closed by cross bars, screws, and catches for holding the end of the cross bars in their place, one end of the fire-door bar being hinged, turns back when the door is to be opened; *p*, is a spyhole to facilitate the inspection of the fire, without the necessity for opening the fire-door; *q*, are the grate bars, and *r*, is the feeding tube through which the fuel is supplied to the fire. At the top of this tube is fitted a hopper, and below this hopper is a feeding revolving box or cup, carried by the transverse spindle, which is provided with a ratchet wheel, actuated by a pall on the feeding lever, *s*, the free end of this lever is worked by the link, *t*, connected to the lever arm, L, hereinbefore referred to. By this arrangement, at each stroke of the levers, L, the cup fast on the spindle of the ratchet wheel will be gradually turned and eventually inverted, thereby discharging its contents of small coal or other fuel down the feeding tube, *r*, into the fire. *v* is the escape or exhaust pipe, and *u* is a safety valve or pressure regulator, kept closed by a blade spring. The motion of the piston of this engine is derived from the direct action of the heat of the fire beneath it. Air is forced into the furnace by the plunger, *c*, of the air-pump, which produces an intense combustion of the fuel. The heat thus evolved acts directly upon the piston, C, in the cylinder, A, and by its expansive force, drives the piston in an upward direction. Upon the ascent of the piston, C, the expanded air escapes through the valve chest, V, and in the valve away by the exhaust pipe, *v*. The difference of temperature and pressure on the two sides of the piston thus causes its descent, and in this manner the reciprocatory movement of the engine is obtained.



LAW REPORTS OF PATENT CASES.

SHIPS RIGGING: HOWES *v.* THE GREAT SHIP COMPANY.—This action was tried in the Court of Queen's Bench, before Lord Chief Justice Cockburn, and a special jury. The plaintiff in this action, Ebenezer Howes, was an American captain, and the inventor of a new mode of rigging sailing vessels, and he sued the defendants, the Great Ship Company, to recover the sum of £277, which he claimed in the nature of a royalty, due to him by the defendants, for using his patent rigging in the Great Eastern. The plaintiff's invention appeared to be a very simple and useful one, and consisted in a mode of applying and supporting a second or extra topsailyard to the cap of the lower masthead, and also a crane or brace to the heel of the topmasttop or trestle trees to the lower mast, the object being to lower down the upper topsailyard into close proximity with the second or extra yard. According to the invention the topsail was divided into two parts, and might be reefed or taken in with one-third the number of men necessary to secure the same result on the old plan. By the old plan the yards were supported by a chain attached to the topmast above each yard; the upper topsailyard, therefore, could not be lowered below the point of attachment of such chain to the topmast, and of course the sail would be "bellied out" by the wind, and required considerable tackle and a large number of men to take it in; but, by the plaintiff's improvements, the upper yard might be lowered down to the new yard, and the upper half of the topsail, as divided, dropped behind the lower half of the sail. After it was taken in, or furled, the lower half was clewed in from the deck by the usual tackle and in the ordinary way. No question was made on the part of the defendants as to the utility of the plaintiff's invention, or as to the fact of its having been used on board the Great Eastern, it being required by Captain Harrison as absolutely essential in a vessel of that nature, where the sails were of such immense size, and could not otherwise have been managed. Evidence was given by the plaintiff's agent that the orders were given by Captain Harrison, who was the captain of the vessel, and that he was referred by the directors to Captain Harrison for orders.

The defendants' counsel admitted that the plaintiff's patent rigging had been used, and that it was a part of Mr Brunel's original design that it should be adopted; but the defence was that Mr Scott Russell was the person with whom the company had contracted for the construction of the rigging, and that Captain Harrison had acted as agent of Mr Russell, and not of the company, in giving orders.

Several witnesses were examined on the part of the defendants, to show that Mr Scott Russell had contracted with the company to supply the rigging, and that Captain Harrison acted as his agent in superintending the rigging and giving orders to the plaintiff's agent. It was admitted, however, that Captain Harrison had some authority to give orders on the part of the company, and the plaintiff contended that, in ordering the plaintiff's rigging, he was acting within the scope of his authority so as to bind the company.

Lord Chief Justice Cockburn summed up the evidence to the jury, and left it to them to say whether the captain, in giving the orders, acted as the agent of Mr Russell or of the company, and told them to find their verdict accordingly.

The jury, after a long absence from court, found their verdict for the defendants.

Mr Bovill, Q.C., and Mr Watkin Williams appeared for the plaintiff; and Mr Edwin James, Q.C., Mr Lush, Q C., Mr Horace Lloyd, and Mr Clover for the defendants.

The Great Eastern: Russell *v.* the Great Ship Company.—In this case Mr Horace Lloyd moved for a rule calling on the plaintiff, Mr John Scott Russell, to show cause why three several actions brought by him against the Great Ship Company should not be consolidated. The first was brought upon an award made in August last; the second in respect of additional work done beyond his contract, and for damages for interruption by reason of exhibiting the great ship to visitors during the progress of the works; and the third for damages by reason of the defendants having declined to register the transfer of certain shares in the Great Ship Company belonging to the plaintiff, and which he had attempted to dispose of. There was no reason why the three actions should not be consolidated. The award gave £18,000 to Mr Russell, and if the plaintiff succeeded in the action on that award he would substantially recover the damages he sought for in the other actions, as the award covered the demands set forth in those actions. The defence to the action on the award was, that the arbitrators had gone beyond their authority, and had awarded damages for matters not within their order of reference.—Mr Bovill, Q.C. (with whom was Mr Watkin Williams), said that Mr Scott Russell had entered into a contract to do work on the Great Eastern amounting to £125,000, and, with extras, he had claimed payment for £129,000. He also claimed damages for the delay to which his work had been subjected by visitors going on board the ship. It was arranged that all differences should be left to two arbitrators, with power to call in a third. On the other side the defendants made a claim against Mr Russell of £130,000. Finally the arbitrators had awarded that £18,000 was due to Mr Russell. The plaintiff had then applied to the Queen's Bench to enforce the award, and the defendants had applied to set it aside. The Court, after hearing both parties, discharged both rules, and left the plaintiff to his legal remedy. The plaintiff then brought his present action on the award, and the defendants said the arbitrators had no power to make any award in respect of extra work, and damages arising from delay caused by visitors to the ship. If all the three actions were consolidated the second cause of action could not be tried, and must be referred, and all the delay and expense which had been incurred would be thrown away. Then, as to the third action, there was no reason why the claim respecting damages for not registering the transfer of the plaintiff's shares should be mixed up with the other causes of action.—Mr Justice Keating: If you succeeded in the first action it would not be necessary to go on with the others.—Mr Bovill said it would not. The expense of the arbitration in arbitration fees alone had already been £1,000. The plaintiff would be perfectly content to take the amount of the second award in full satisfaction of all claims.—Mr Llyod: We are about to commence several actions against Mr Scott Russell, for the balance is in our favour.—Mr Bovill: We offered to refer the whole matter to any gentleman of the bar, leaving his judgment perfectly unfettered, with power to refer to the arbitrators; but the defendants refused that.—The Chief Justice suggested that the first action should be turned into a special case for the judgment of the Court, and that that should be decisive.—Mr Bovill, said there was a prospect of "bills of exceptions," the Exchequer Chamber, and the House of Lords. The object of bringing the three actions at once was to save time. Money was now worth 7 per cent., and this was a company of limited liability, and the property was in the ship.—The Chief Justice suggested that the plaintiff should stay the second actions till the opinion of the Court on the action on the award was obtained. After some further discussion, the Court ordered a stay of proceedings on the second and third actions until a further order thereon.

Shipbuilding: Blyth *v.* Samuda.—This case was heard in the Court of Queen's Bench, Guildhall, before Lord Chief Justice Cockburn and a special jury. The plaintiff sued the defendant, to recover damages for the breach of a contract into which the parties had entered on the 16th of August, 1858, whereby the defendant had contracted to build an iron steamtug for the plaintiff, according to the specifications annexed to the agreement, for the sum of L.5000. The plaintiff complained that the vessel was not built according to the specifications The defendant pleaded the usual pleas, and also an equitable plea, in which he alleged that the variations were made with the knowledge and consent of the plaintiff, and that he waived them.

It appeared that the plaintiff had entered into a contract with the Mayence Steam Towing Company to supply them with an iron steamtug, of a shallow draught of water, to be used upon the Rhine, and entered into a sub contract with the defendant to construct the hull of the vessel, to which he was himself to add the steam engine and boilers. The agreement with the defendant recited the contract with the Mayence Company, but it bound the defendant to construct the vessel according to the specifications annexed. According to these specifications the deck beams were to be of iron, fastened to the sides by knees and angle irons, and the whole were to be connected by two stringer plates lying on the ends of the deck beams and running from end to end of the vessel, and riveted to the deck beams and connected with the sides of the vessel. The defendant, however, substituted wooden deck beams for the iron beams, and, instead of the iron stringer plate, he put a wooden shelf, his object in doing so being to lessen the draught of the vessel, and to secure that it should not draw more than three feet of water. The vessel was constructed throughout under the inspection of the plaintiff's manager, and before it was launched the plaintiff called the defendant's attention to the deviation from the specifications, and told him that the responsibility of its being satisfactory to his Mayence friends must rest with him. The defendant replied that the Mayence Company, in their specification of requirements, asked for wooden deck beams, and that, when wooden deck beams were adopted, a wood shelf was invariably given to attach them to, and not an iron stringer, and that throughout the vessel he had, as arranged with the plaintiff, adopted the requirements received by the plaintiff from abroad, and in no case done anything inconsistent with them. The plaintiff again wrote to say he was glad to find the defendant thought the arrangement would be satisfactory to the Mayence Company, which was his only object in calling his attention to the point, as he was desirous that no cause of complaint should arise against the builders. The vessel was finished and launched on the 18th of December, 1858, and, after being fitted with her engines by the plaintiff, two attempts were made to steam over to Rotterdam, but, as the weather was unfavourable, the vessel returned. A third attempt was made in fair weather, but the vessel met with a heavy swell from the North Sea, which caused it to pitch and labour a good deal, and the result was that on its arrival at Rotterdam the Mayence Company would not accept the vessel. The sides of the vessel had bent, or "buckled," and the bottom had sunk six or seven inches in the middle. A claim was made upon the insurance company for damage done by the perils of the sea, and L 850 was paid; but, as the company would not accept the vessel under their contract, the plaintiff eventually made a new contract with the Mayence Company, and sold the engines to them at a reduced price, and the vessel, for which he had paid the defendant L.5000, for L.1450. He now sought to recover the difference in the present action, upon the ground that the "buckling" of the vessel, which caused the Mayence Company to reject it, was caused by the substitution of wooden deck beams and a wooden shelf for the iron deck beams and iron stringer plate. Several scientific witnesses were called to support this view of the case.

The defence was, that it was necessary to have wooden deck beams in order to secure that the vessel should draw only three feet of water, and that the deviation from the specifications had been adopted, with the plaintiff's full knowledge and consent, in order to secure this result, and that it had been finally accepted by him, and paid for, in satisfaction of the contract. The defendant's witnesses attributed the "buckling" to the stormy weather which the vessel encountered, and for which it was not adapted, and not to a deviation from the specifications; and they gave it as their opinion that a vessel constructed with a strong wooden shelf, as this was, was better adapted to resist the force of the waves than if it had been constructed, in accordance with the specifications, with iron deck beams and an iron stringer.

Towards the end of a three days' trial Lord Chief Justice Cockburn summed up the evidence, and eventually left three questions to the jury—1, whether the deviations were made with the consent of the plaintiff; 2, whether the vessel was accepted by the plaintiff in satisfaction of the contract; and, 3, whether he kept the ship an unreasonable time?

The jury retired, and on their return into court answered all the questions in the affirmative, and so found for the defendant.

Mr Bovill, Q.C., Mr Lush, Q.C., and Mr Turner appeared for the plaintiff; and the Solicitor-General, Mr Collier, Q.C., and Mr Cleasby for the defendant.

TYPE FOUNDING: THE PATENT TYPE FOUNDING COMPANY *v.* RICHARD, *et al.*—This was an action in the Court of Common Pleas, before Lord Chief Justice Erle and a special jury. The patent in question was taken out in 1854, by Mr Johnson, and this patent was now vested in the plaintiffs. The defendants, Messrs Miller & Richard, were extensive type-founders in Edinburgh. Before Mr Johnson's patent type was made out of a combination of lead and antimony, there being about 75 per cent. of lead, various attempts had been made to harden type metal, some persons using copper and others zinc, and in the Exhibition of 1851, there was shown a French invention for making type out of copper wire by pressure without fusion. It turned out, however, that copper would not stand washing, and the invention, therefore, became useless. Mr Johnson had been engaged since 1849 in inquiring into the matter, and he was aware that a small proportion of tin had been put into type metal to make it "tougher," but nobody had used it to "harden" the metal. It could not be accounted for chemically that a larger proportion of a soft metal should make the compound harder; but Mr Johnson found that by using a large proportion of tin he could make a metal that would fuse readily, cool quickly, and come out so hard that you could use the metal as a punch when applied to the ordinary type metal. Mr Johnson accordingly took out a patent, in which he said that he claimed every combination of the three metals, which contained 25 per cent. of antimony and 75 per cent. of tin and lead, of which the minimum of tin must be 25. The defendants in their circular, issued in January, 1856, stated that they had during the last ten mouths been augmenting the strength of their metal, and this enabled them with confidence to offer a quality of type surpassing every other; and they sold type to the *Times* and other establishments. This type, the plaintiffs contended, had been made in violation of their patent rights, the type having in it more than 25 per cent. of tin. The defence was, that it had been long known that tin possessed the quality of hardening the metal, and it had been used in combination for making ship nails, which were so hard that they would penetrate oak without being blunted. In Savage's "Dictionary of the Art of Printing," published before the patent, there was a description of tin, lead, and antimony being used for type metal very much in the proportions given in Mr Johnson's patent; and in a treatise on English founding and foundries, published in 1778, a mixture of tin and lead was described as being less flexible and more solid and durable than lead. The French Encyclopædia also said that a great quantity of tin was used in combination with lead and antimony. Beyond this the defendants had for many years used tin, and the principle of the use of tin as provided for by Mr Johnson's specification was not new, and therefore his patent was not a valid one. A great deal of evidence on both sides was laid before the jury, and in the course of the evidence for the defendants the jury stopped the case, and a non-suit was entered.

IN THE MATTER OF FERGUSON'S PETITION FOR PATENT—PATENT OPPOSITION BEFORE SOLICITOR-GENERAL.—On the 12th July, 1860, John Ferguson of Glasgow, North Britain, veneer cutter, petitioned for letters patent for an "invention of improvements in machinery or apparatus for sawing or cutting wood into veneers and planks." A communication from abroad by J. F. C. Wieland, of the city of Hamburg, machinist. The applicant having given notice to proceed with his patent, an opposition was duly entered on behalf of Theodor Andreas Prale, of Hamburg, which now came on for hearing before the Solicitor General. The main objection to the grant of the letters patent to John Ferguson, as alleged in the notice of objections, was, "That the alleged invention, or material parts of it, were comprized in letters patent granted to August Pentzlin, dated the 29th March, 1860." Ferguson's invention is described in his provisional specification to relate to the arrangement and construction of veneer or plank-cutting machinery, and the provisional specification describes such machinery in a general manner, and contains the following statement:—"By this means the timber-carrying frame may be moved up and down by hand as required, but it has also an upward vertical motion imparted to it from the engine or other prime mover. The object of this arrangement is to afford facility for moving the timber carrier by hand as required; but when the saw is in operation, the *carrier* is moved solely by the engine, and *always* in an *upward* direction, which is an essential feature of this invention. It will be observed that, inasmuch as the timber-carrying frame in Ferguson's machine has an *upward* motion, the *saw* blade to be employed would have its *cutting edge* directed *downwards.*" It was contended on behalf of the opposer, that Pentzlin's invention, as specified, included the alleged essential feature of Ferguson's invention already referred to, namely, the upward direction of the timber carrying frame, and consequently the working of the saw with its cutting edge directed downwards. Pentzlin's provisional specification, after stating that the invention relates to certain improvements in machinery for cutting wood, portions or modifications of such improvements, having for object the cutting of veneers, whilst other portions or modifications are suitable for sawing planks or boards of various thicknesses, states—"In a veneer-cutting machine, embodying a modification of the improvements, a reciprocating saw blade is used, placed and working by preference horizontally, and with its cutting edge directed *upwards.* The block or log from which the veneer is being cut is mounted on a moveable frame, which is guided by fixed standards, and is adjusted forwards or backwards by a screw provided with an index, to give the requisite thickness of veneer, whilst the *lowering* movement for feeding the block *down* to the saw comprises a screw actuated by cone pulleys." Pentzlin, in his final specification, which was filed 20th Sept., 1860, after particularly describing his machine, states—"In this machine a reciprocating saw blade A is used, placed, and working by preference horizontally, and with its cutting edge directed *downwards* (not upwards, as by mistake stated in my provisional specification)." On behalf of Mr Prale it was submitted that, upon the true construction of Pentzlin's provisional specification, the moveable or timber-carrying frame might be directed either upwards or downwards, and that, notwithstanding in his final specification he had called attention to what he had therein designated a mistake, yet that no mistake existed—that, upon the construction to be put upon the words "in a veneer-cutting machine, embodying a modification of the improvements, a reciprocating saw blade is used, placed, and working by preference horizontally, and with its cutting edge directed upwards," it was submitted that the words "by preference" had reference not only to the working horizontally of the saw blade, but likewise to the *direction* of the cutting edge of the saw blade. On the part of Mr Ferguson it was insisted, that the true construction to be put upon the words in question is to confine the reference of the words "by preference" to the *working* of the saw blade, and not to the *direction* of the *cutting edge.* It was, moreover, insisted that the *direction* of the cutting edge, and, consequently, the motion of the frame, or timber-carrier, was of the very essence of both Ferguson's and Pentzlin's inventions—that the *nature* of an invention, as declared in a provisional specification, could not be altered in the final specification—that Pentzlin's *final* specification was insufficient and invalid, as not duly specifying *the* invention for which the letters patent had been granted, by reason of its differing, in a material part, with the provisional specification—that, if Pentzlin's final specification was insufficient, then his patent would be void; and inasmuch as Ferguson's letters patent, if granted, would bear date *anterior* to the filing by Pentzlin of his final specification, the latter specification would be inadmissible as evidence of prior publication of Ferguson's invention, and Ferguson's patent would, so far as that specification is concerned, be a good and valid one. The Solicitor-General having heard the arguments on both sides, said that some very important questions had been raised, on behalf of Mr Ferguson, as to the validity of Mr Pentzlin's patent. These questions he could not take upon himself to decide, and should therefore grant his warrant for sealing Mr Ferguson's patent. Mr J. Henry Johnson, of 47 Lincoln's Inn Fields, and Glasgow, appeared on behalf of Mr Ferguson.

TELEGRAPH CABLES: GLASS, *et al*, *v.* BOSWALL.—This action was tried in the Court of Common Pleas, before Lord Chief Justice Erle and a special jury.

The declaration stated that the plaintiffs were manufacturers of electric telegraph cables, and were about to lay down a submarine telegraph cable; and that the defendant, intending to injure the plaintiffs, drove and caused to be driven an iron nail into the said cable, whereby the said cable became injured, spoiled, and useless, whereby the plaintiffs incurred great charges and losses in and about the taking up and repairing the cable.

The plea was "Not Guilty."

The plaintiffs' case was that in September, 1858, they were employed, in pursuance of a contract they had entered into, in laying down a telegraphic cable between England and Zandvoort, in Holland, and had sent out a quantity of the cable on board a ship of theirs, the William Cory. On the 22d of that month it was discovered that the cable, which was tested every ten minutes or a quarter of an hour, had sustained injury, and it proved on examination that the wire No. 2 had ceased to act. This involved the necessity of taking up part of the cable (which, together with other matters thereto incidental, involved a cost to the plaintiffs of between L.7000 and L.8000), when it was discovered that a nail had been driven into the cable by some person on board, which had caused the damage. The plaintiffs consulted Messrs Humphreys & Co., solicitors, as to the means to be adopted for discovering the perpetrators of the mischief, whose advice was to offer no reward, but suffer the matter to rest, in which case something might possibly in time "ooze out." This course the plaintiffs adopted, and about Christmas, 1860, in consequence of certain proceedings in Chancery between Messrs Newall & Co. (who are also telegraph cable manufacturers), and the plaintiffs respecting sundry alleged infringements by the plaintiffs of a patent of which Messrs Newall & Co. were proprietors, for "paying out" marine telegraph cables, it became necessary for the plaintiffs to institute certain inquiries of some of the crew of the William Cory, and one of them—a man named Curtis—being questioned, and exhibiting symptoms of guilty confusion, was taxed by one of the plaintiffs with having damaged the cable, which he admitted, alleging that he had done so at the instigation of the defendant, who is the foreman and confidential agent of Messrs Newall & Co. To this effect Curtis, who was called as a witness on behalf of the plaintiffs, gave evidence, stating also that it was at the defendant's instance that he sought for and obtained employ on board the William Cory, in order that he might have an opportunity of damaging the cable, which he did as above stated.

The defendant, who was also called, utterly denied the truth of the statements of Curtis with respect to any instruction from him (defendant) respecting the injury of the cable, alleging that the instructions given to Curtis simply referred to watching the mode of "paying out" the cable, with a view to the protection of the patent of Messrs Newall & Co.

The learned judge having summed up, the jury, after a lengthened consideration, found a verdict for the plaintiffs, the amount of damages to be the subject of reference. Mr M. Chambers, Q.C., Mr Cleasby, and Mr Bidder were counsel for the plaintiffs; Mr Bovill, Q.C., Mr Denman, and Mr Quain for the defendant.

Fibrous Materials: Schlumberger, *et als*, v. Salt.—This was an action tried in the Court of Queen's Bench, Guildhall, before Lord Chief Justice Cockburn.

The plaintiffs, Messrs Schlumberger and others are the executors of Josue Heilmann, to whom a patent had been granted in the year 1846 for certain improvements in the manufacture of machinery for combing wool, cotton, and other fibrous materials. The defendant, Titus Salt, is a worsted manufacturer at Bradford, and the present action was brought against him to recover damages for the breach of a covenant into which he and Messrs Akroyd & Co., of Halifax, had entered with the plaintiffs in a deed executed between the parties on the 28th of August, 1853. The plaintiffs had granted to the defendant and the Messrs Akroyd a license to make and use machinery in accordance with Heilmann's patent, so far as related to the combing of wool, subject to a covenant that the defendant and the Messrs Akroyd (their executors, &c.) should "not manufacture under, or by virtue of, the said license, for sale out of England;" and the complaint made in the present action was, that the defendant, or rather his assignee, Mr Lister, had committed a breach of this covenant by manufacturing machines, according to Heilmann's patent, for sale in various parts of France and Germany. The question of the validity of Heilmann's patent was tried in this court some years since, when its validity was established. The improvement which it introduced was considered to be of great value, and the right to use it in Great Britain and Ireland was sold to the defendant and the Messrs Akroyd for the sum of L.30,000. They afterwards assigned this right to a Mr Lister, a large manufacturer of machinery at Bradford, and he had carried on the manufacture to a large extent, and had realized large sums of money by the sale of the patent machinery. The plaintiffs were manufacturers of machinery at Gwebweller, in the department of the Upper Rhine, in France, where they manufactured their machinery under Heilmann's patent, which they had purchased; but in the year 1858 they discovered that Lister, (the defendant's assignee), was manufacturing the patent machinery for sale not only in the United Kingdom, but on the Continent. When he was first taxed with a breach of his covenant, Lister said he had only sold two or three of such machines abroad, but, when the action was brought, and he was examined on interrogatories, he admitted that he had sold nearly 100. The machines realized an enormous profit, and the only question now was, as to the amount of damages which the plaintiff was entitled to recover from the defendant, who was only the nominal defendant, the real defendant being Lister, the defendant's assignee, who had committed the breach of covenant.

After the examination of one witness, the trial was brought to a sudden close by the defendant's consenting to a verdict for the plaintiffs with L.5000 damages.

Mr Bovill, Q.C., Mr Hindmarch, Mr Coleridge, and Mr Hannen appeared for the plaintiffs; and Mr Edwin James, Q.C., Mr M. Smith, Q.C., Mr Lush, Q.C., and Mr Webster for the defendant.

Disclaimer Practice before the Law Officers—In the Matter of Polson's Patent—Before the Solicitor General.—This was a petition of John Polson, of Paisley, N.B., for leave to disclaim certain parts of the specification of letters patent granted to him on the 21st March, 1854, for "Improvements in the manufacture of starch." Mr Polson's specification, as originally filed, extended to improvements in "the manufacture of starch from Indian corn or maize, and from rice," and consisted *first*, in steeping the grain, either whole or coarsely ground or bruised, then bruising or pulping the grain, by a revigating machine; the pulp is then mixed with water, and the husks and fibrous matters separated by sieves; this revigating and separating process is again repeated if desirable. The husks and fibrous matters may then be dried and ground for feeding cattle, whilst the starchy matter, separated by the sieving process, has to be separated from the gluten and other matters mixed with it, by any one of three processes afterwards described. Mr Polson, at the conclusion of his specification, claimed *first*, the general combination of process to be adopted in the manufacture of starch from maize or Indian corn, and rice, as described, and under *second, third* and *fourth* heads, details of the invention.

The petition to the law officer, was for leave to enter a disclaimer of all parts of the specification which related to the manufacture of starch from rice, to omit any reference to the subjection of the husks to the separating and sieving process for a second time, and also to disclaim the third process for the separation of the gluten and other matters remaining in the starchy matter, after the husks and fibrous matters have been separated from it. The patentee also petitioned to disclaim all his claims for details, leaving only the first or general claim for the combination of process.

This petition was opposed by manufacturers of starch at Hull and at Paisley, represented by Mr Macrory, of the common law bar, whilst it was supported by Mr J. Henry Johnson, of 47 Lincoln's Inn Fields, and Glasgow.

The matter came on for hearing before the Solicitor General on the 22d February last.

Mr Johnson, in opening the case, explained the nature and objects of the proposed disclaimer to be simply the cutting out of certain parts of the processes patented, not in themselves altogether new or useful, the petitioner not seeking in any manner to extend his patent.

Mr Macrory, on behalf of the opposers, did not object to the disclaiming the word rice from the specification, but he opposed the other portions of the intended disclaimer on the ground that the patent right would thereby be extended—his argument being based on the assumption, that the three processes for separating the gluten were continuous processes, and that the cutting out of any one of them would raise a claim for a new combination not covered by the specification originally. He also contended that the second, third, and fourth claims had the effects of words of limitation, as showing the component parts of the combination or first claim.

Mr Johnson, in reply, urged that the specification, as it stood, could not in any way bear the interpretation put upon it by Mr Macrory, and that, if the law officers were governed by precedents, he could adduce instances of many disclaimers precisely similar in their nature and effect to that petitioned for. The first, second, and third processes for separating the gluten could clearly be employed separate and apart from each other, and the second, third, and fourth final claims were claims for details, or subordinate combinations, which, to prevent mistakes, the patentee was now desirous to get rid of.

The Solicitor General, after a most careful examination of the specification, and patient hearing of the arguments on both sides, took time to consider his decision. He has since allowed the disclaimer precisely as petitioned for.

TRADE MARKS BILL.

In the House of Lords, on the 4th ultimo, the Lord Chancellor, in moving the second reading of this bill, said he had received a number of communications from eminent manufacturing firms, expressing their delight at the prospect of at last obtaining protection for their trade marks. The forgery of these marks inflicted a double injury on manufacturers, for it brought discredit upon their productions, as well as robbed them of the fruits of their skill and industry, and it was carried on to a very great extent. Hitherto there had been no remedy against it, except by an application to the Court of Chancery, or a suit at common law. It was proposed in this bill to make the forgery of trade marks a misdemeanour, liable to the punishment of fine or imprisonment. It had been suggested by some members of the mercantile community that there ought to be a registration of trade marks throughout the United Kingdom; that no trade mark should receive protection which was not registered; and that registration should be accepted as conclusive evidence of the property in such a mark. He believed, however, that that system would be very complicated and expensive, and that the measure was better as it stood. There were also clauses in the bill making it a misdemeanour in any one to use labels stating falsely the quantity or quality of the goods to which they were attached. He was doubtful whether he should retain the clause of the bill with reference to works of art, as it might perhaps be found to come in more appropriately in the bill which had been introduced into the other House on the copyright of such works. His lordship concluded by moving the second reading of the bill.

Lord Chelmsford approved generally of the measure, but believed that amendments might be introduced in committee to render its operation more effectual.

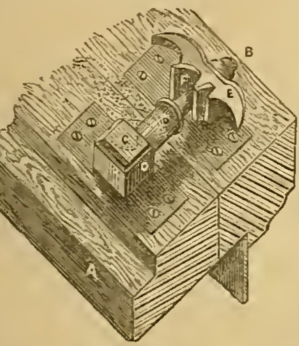
The bill was then read a second time.

REGISTERED DESIGN.

SASH FASTENER.

Registered for Messrs Linoham, Brothers, *Birmingham.*

This design comprehends a simple mechanical arrangement, of easy action, for securely fastening window sashes and preventing rattling in stormy weather. The outer sash, A, has screwed to it a socket piece, and on the inner sash, B, is secured the catch piece of the fastener. The socket on the sash, A, has jointed to it the end-piece, C, of the barrel, D, in which is arranged a helical spring. This spring acts upon a disc formed on the inner end of a small spindle, which works out through the end of the barrel, D. The outer end of the spindle is attached to a duplex finger-piece, E, which is fastened by pressing it down over the inclined surfaces of the catch, F. This causes the spring in the barrel, D, to be compressed, and the outer portion of the finger piece, E, slips under the notched part of the catch, F, where it is securely held by the pressure of the helical spring against the disc of the finger piece. The fastener is released in a moment by placing two of the fingers against the curved ends of the finger piece, E, and drawing it inwards, so as to compress the helical spring to a greater extent, and so release the finger piece. Below the end piece, C, is a moveable plate which is pressed upwards by a spring and serves to retain the moveable part of the fastener in a vertical position when thrown back. The improved fastener has an exceedingly neat appearance, and is far superior in point of utility to the old-fashioned spring catch.



REVIEWS OF NEW BOOKS.

The Successful Application of Charcoal Air-Filters to the Ventilation and Disinfection of Sewers: a Letter to the Right Honourable the Lord Mayor, William Cubitt, M.P. By John Stenhouse, LL.D., F.R.S Churchill, London. Pp. 20.

In this admirable letter the results are detailed of some experimental trials which have been made, both in the metropolitan districts and also in several parts of the country, of the disinfecting power of Dr Stenhouse's charcoal air-filter, when applied to the palings of sewers.

In order that our readers may fully appreciate the simplicity and excellence of this arrangement, we will describe its construction and applications in the Doctor's own words:—

"The charcoal air-filter consists of a layer of charcoal in coarse powder, varying in size according to circumstances, between a small beam and a filbert. The charcoal is placed between two sheets of wire gauze fixed in a frame, and can be readily applied to buildings, to ships, to the air-shafts of sewers, to water-closets, to respirators, and various other purposes. All the impurities in the air are absorbed by the charcoal, so that a current of pure air alone passes through the filter, and in this way pure air may be obtained from exceedingly impure sources."

The reason why these filters so effectually destroy the impurities existing in an atmosphere, arising from sewers or other sources of effluvia, is this, "charcoal, from the considerable amount of condensed oxygen contained within its pores, amounting to between nine and ten volumes, not only absorbs, but rapidly oxidizes the effluvia and miasmata emitted by decaying substances, and resolves them into the simplest combinations they are capable of forming."

Of the duration of the disinfecting power of the charcoal in these filters we will give an instance:—

"Before the close of the year 1854, air-filters, or charcoal ventilators, were fitted up both at the Mansion-House and Guildhall. They are each of them several feet in diameter, the layer of charcoal being about one and a half inches in thickness. Although six years have elapsed, the charcoal has never required to be renewed, owing to its oxidating power being practically unlimited."

Where the air-filters have been adopted, the results, in every instance, have been most highly satisfactory; and it is to be hoped that this simple but efficacious means of disinfecting an atmosphere contaminated with deleterious gases, will receive that degree of attention which it so justly merits.

A Practical Treatise on Coal, Petroleum, and other Distilled Oils. By A. Gesner, M.D., F.G.S. New York and London: Bailliere Brothers.

It has been stated by Liebig, and with some degree of truth, that the state of civilization arrived at by a country may be estimated from its production and employment of sulphuric acid—that being, as it were, the talisman by whose powerful intervention so many of the useful and necessary wants of civilized life are produced. We think that with equal truth it may be asserted that the advancement made by a country can as correctly be estimated from a knowledge of the means which are employed for the production of artificial light, and from the extent to which such artificial illumination is adopted. But a comparatively short time since, the only materials employed for the artificial production of light, were spermaceti, tallow, vegetable and animal oils, with the exception of wax, sperm, and sperm oil. The employment of all other illuminating materials was attended with such inconveniences as are now difficult to realize. In proportion as our means of producing illumination have increased, so has its cost been diminished; and perhaps we have no better confirmation of the fact than when we consider how cheaply and abundantly the artisans and the poorer classes of this country are now supplied with artificial illumination, derived either directly from coal, or obtained indirectly from bituminous or other natural products or exudations.

Omitting any considerations as to the production of permanent illuminating gas from coal, we wish rather to draw the attention of our readers to the production of the solid and liquid illuminating materials now obtained, both from coal and from bituminous and other natural products; and, in so doing, we would refer to a Table containing a list of some of those coals and other substances which are now employed, and also giving the amount of illuminating products obtained, which Table we extract from a work lately published in America, by Dr Gesner:—

Locality.	Volatile Matters.	Coke.	Yield of Crude Oil per Ton.
England.			
Derbyshire	48·36	53	82 gallons.
Wigan Cannel	44	56	74
Liverpool ,, ...	39	61	50
Poole (Shale)	43	58	50
Newcastle	35	65	48
Scotland.			
Boghead	70·10	29·90	120
Scotch Cannel	38	62	40
Lesmahago	51	49	96
Provincial.			
Albert Coal, N. Brunswick .	61·050	30·65	110
Asphalte Rock . . .	43	57	64
Pictou Shale, Nova Scotia .	27	73	47
American.			
Breckenridge	61·30	38 55	130
Erie Railroad	35	65	47
Newburg	38	52	72
Falling Rock	50	50	80
Pittsburg	36	64	49
Kanawha	46	54	71
Elk River	41	59	60
Connelton	34	66	86
Coshoctou, Ohio	45	54	74
Bitumen, &c, United States.			
Ouachita River, Arkansas .	60	40	64
Ritchie Country, Virginia . Pennsylvania	...	...	170 galls. per ton.
Petroleum Springs,—Alabama, Georgia, Tennesse, Kentucky, Virginia, Maryland, Ohio, Pennsylvania . . .	...	...	From 70 to 90 ℔ cent. of Lamp Oil.
Cuba.			
Bitumen	71	29	120
Trinidad.			
Bitumen	38	52	70
Canada.			
Bitumen	70	30	48

The substances employed in this country for the production of illuminating materials are bituminous coals, such as the boghead and cannel coal. Bituminous shale has also been distilled in Dorsetshire, but to no very great extent. Several of the natural products are also employed as sources from whence to obtain illuminating materials. These natural products are rangoon tar or petroleum, bitumen from Cuba, and other natural products or exudations. At the present time, large importations are anticipated of the natural petroleum or mineral oil, from America, which is being there obtained in immense quantities; and it is also not improbable that the Trinidad bitumen will, ere long, be distilled, either in Trinidad or in this country, as a source of illuminating materials. It is known to our readers that when bituminous coal is subjected to a high temperature, in a closed vessel, such as a gas retort, that we obtain what is known as coal gas, or illuminating gas, tar, the so-called oil of tar, and coal tar naptha; but if, instead of subjecting bituminous coal, more especially that class of coals known as cannel coal, to a distillation at a high temperature, they are subjected to distillation at a low red heat, the products obtained are very different to those resulting from the application of a higher temperature. We obtain, in fact, but a small amount of permanent gas and tar, a large quantity of oil, no coal tar naptha, but a body which differs very materially from benzole, or the more volatile portion of coal tar naptha. This forms the essence of the discovery of Mr Young; and it is this discovery which has led to the introduction into commerce of the paraffin oil now so universally employed. It is, then, by effecting the distillation of bituminous coals at a low temperature—a temperature between 700° and 1000° Fahrenheit, that these liquid and solid products, suitable for illumination, are obtained. The natural products, such as rangoon tar, petroleum, and the mineral oil from America, and from other sources, are subjected to a process of distillation simply for the purpose of separating the several compounds existing in the natural product, which may be considered as corresponding to those crude products which are obtained on subjecting bituminous coal to distillation at a temperature not exceeding that of a low, red heat.

The commercial products which are obtained from bituminous coals, when subjected to distillation at a low temperature, as also those which are obtained by the distillation and rectification of the natural products of which we have spoken, are paraffin, the so-called paraffin or lubricating oil, a lighter oil, which is technically known as the burning oil, and a small quantity of a light naptha.

In order that the difference in the products obtained on subjecting coal to distillation at different degrees of temperature may be understood, we append a statement from Dr Gesner's work, shewing the products which are obtained from Newcastle Cannel coal when subjected to distillation at a high or at a gas making temperature, and also when the same coal is subjected to distillation at a temperature of about 800°. In both instances one ton of coal was employed.

DISTILLEN FOR GAS.		DISTILLEN FOR OILS.	
Products.		Products.	
Coal Gas, - -	7·450 cub. ft.	Gas, - - -	1·400 cub. ft.
Coal Tar, - -	18½ gals	Crude Oil, - -	68 galls.
Coke, - - -	1,200 lbs.	Coke, - - -	1,280 lbs.
Products of the Coal Tar.		Products of the Crude Oil.	
Benzole, - -	3 pints	Eupion, - - -	2 galls.
Coal Tar Naptha, -	3 gallons	Lamp Oil, - -	22·5 galls.
Heavy Oil Napthaline, &c.,	9 gallons	Heavy Oil & Paraffin,	24 galls.
Total, - -	12⅜ galls.	Total, - -	48·5 galls.

Dr Gesner, after giving a short history of the production of oils from coals and other bituminous substances, enumerates those coals and other bituminous substances which are now employed in this country and in America; but one of the most interesting portions of his work is that in which he describes the petroleum wells, now being sunk in so large a scale in the United States. It is admitted that the Alleghany bituminous coal field occupies an area of 63,000 square miles, and that at numerous places throughout this coal region, petroleum reservoirs have been found. The manner in which the petroleum is obtained is stated to be as follows:—

"To obtain the petroleum, holes of three or four inches diameter are drilled through the debris of the surface and the rocks beneath. When the oil is 'struck' it is forced out by the pressure of the gas below, and flows for some time without the aid of a pump. An iron pipe is inserted into the hole, and so contrived that the surface water shall not enter the well. To the top of this pipe a pump is attached, and worked by hand, or by steam power. So great is the discharge of the petroleum, in some instances, that sufficient vessels cannot be obtained for its reception, and it runs in oily streams over the surface. Some springs yield 200 barrels per day. A reservoir of oil has been opened, near Tideout, Erie County, Pennsylvania, at a depth of 170 feet, which yields 300 barrels per day."

In many of the States, this search for petroleum has been and is now being carried on; and at the present time no fewer than 550 wells have been opened, or the borings are in progress. From those wells to which pumps have been applied, 25,000 gallons of crude oil are said to be raised daily, and the quantity is rapidly increasing. Some idea may therefore be formed of the enormous amount of mineral oil that will be obtained from these sources; and there can be little doubt but that in a very short time America will export very large quantities of this valuable product into Europe. Hitherto this class of oils have not been rendered saponifiable, so that we must still have recourse to tallow, palm oil, and other saponifiable oils for the manufacture of soap; but for all the purposes of illumination, and for the lubrication of machinery, they have and will replace the more costly vegetable and animal oils. We have not entered into the several methods adopted for the distillation of coal, or of other bituminous substances, neither have we entered upon the means of separating the artificial and the natural products, nor of their subsequent purification; we must refer those who are more particularly interested in the manufacture and the production of these products to Dr Gesner's work.

NOTES ON SCREW PROPULSION: ITS RISE AND PROGRESS. By W. M. Walker, Commander, U.S.N. 8vo., 51 pp. D. Van Nostrand, New York, and Trubner & Co., London.

THESE "Notes" were originally presented to the public in the pages of the *Atlantic Monthly*. The author, in a concise manner, touches briefly upon the early history of the screw and its subsequent rise and progress. He informs us that, in 1804, one, John Stevens, of Hoboken, New Jersey, first applied the screw propeller, and succeeded in attaining a speed, for short distances, of seven knots. These essays were, however, subsequently abandoned, and not until the year 1836, when Captain Ericsson and Mr F. P. Smith demonstrated, by experiments on the Thames, the powers of the screw, was any practical result obtained. It is surprising when one reads of the success of these experiments, that the screw propeller should have been so long struggling into favour. The coldness with which his pet idea was received in this country caused Ericsson to look for other patrons, and he was not long in meeting with Captain Stockton, U.S. navy, who greatly interested himself in the new motor.

In 1838 an iron steamer was built, and fitted with the Ericsson propeller, under Captain Stockton's superintendence. Soon after this, the Princeton, 673 tons, and 250 horse power, was laid down, by order of the U.S. Government, and was launched in 1842, with Ericsson's propeller attached. In 1843 the fame of the still new propeller reached the shores of France, and the French Frigate Pomone was supplied with one, and our Admiralty subsequently ordered the Amphion to be fitted with an Ericsson propeller. Smith's propeller had, in the meantime, been slowly, but surely, making its way, and the results obtained from numerous experiments on this propeller, caused numerous modifications to be made on that of Ericsson. Mr Smith, a farmer of Hendon, applied for his first patent in May, 1836, and in 1837 he satisfactorily tried his propeller in a small craft of six tons burthen, by visiting several ports on the coast. Having thus attracted the notice of the Admiralty, the Archimedes, of 90 horse power, and 237 tons, was laid down, and supplied with Smith's propeller—her first experimental trip being made in 1839, when she attained a speed of nearly ten knots an hour. The screw grew rapidly into favour about this time, and consequently we find that the attention of engineers began to be turned to the discovery of the best form of engine. We are here informed that fourteen varieties of engines were brought out for driving it. The author does full justice both to Ericsson and Smith for the great exertions they made in the introduction of their several inventions; but, as we might suppose, he does not forget to extol his own country for the part it took. In speaking of the two great rivals, the author says:—"Ericsson, before interesting himself with the screw, was, as has been seen, an engineer and mechanician of distinguished ability, whereas Smith, in commencing his new vocation, had all to acquire but his first conception. Ericsson could rely upon the fertility of his own genius, was his own draughtsman, and designed his own engines, accommodating them to the new propeller by dispensing with gearing, and adapting them to a speed of from thirty to forty revolutions—a great and bold advance for an initiative step. Smith, on the contrary, not being an engineer, had to entrust the execution of his plans to others whose knowledge of construction was in the routine of paddle-wheel engines; and this accounted for the fact, that all the early British screw steamers were driven by gearing. This want of mechanical resources, on the part of Smith, added to the difficulties of his career; but his resolution and perseverance rose superior to all obstacles, and carried him to the goal in triumph. Briefly, then, these were the respective merits of Smith and Ericsson, in the introduction of screw propulsion; and it is much to their honour that, throughout their career, no narrow-spirited jealousies dimmed the lustre of a noble rivalry."

Further trials of various forms of screws were made in the Rattler against the Aluto paddle-wheel steamer, the result of which was the foundation of our steam navy. The American frigates of the Minnisota class, of course, come in for a large share of praise. They are evidently the author's *beau ideal.* The succeeding pages are devoted to an account of the experiments with the Dwarf, at the suggestion of Mr Lloyd, for the purpose of proving the great efficiency of a "finer run" aft, the result of which established the correctness of Mr Lloyd's opinion. We next have a description of the mode—or rather *a* mode—of lifting the screw by means of toothed racks and worms, illustrated by a woodcut, followed by observations on the advantages and disadvantages of a lifting propeller; the "shake," and other injurious effects produced by a dragging propeller, and suggestions for obviating the same. The famous experimenting cruise of the Arrogant, Dauntless, and Encounter, in 1851, is briefly touched upon, also the experiments of MM. Bourgois and Moll, of the French navy, in 1847 and 1848, with a view to ascertaining the efficiency of all varieties of the screw propeller upon vessels of different models and dimensions. Mr Penn's lignum vitæ bearings are duly recorded, and some suggestions made as to the advantageous use of blowers, or artificial draughts with the boilers of screw engines.

The perusal of these "Notes" has afforded us pleasure, if not much original information. They will be acceptable to the general reader.

The Builder's and Contractor's Price-Book for 1861; containing the latest Prices for Work in all branches of the Building Trade, with the Items numbered for easy Reference, and an Appendix of Tables, Notes, and Memoranda, arranged to afford detailed information commonly required in preparing Estimates, &c. Smith's Edition. Revised by George R. Burnell, Civil Engineer and Architect. 8vo. 286 pp. London: Lockwood & Co.

This valuable little work, assigned by Mr. Weale, the former publisher, to Messrs Lockwood & Co., has now entered upon a sixth edition, and has been thoroughly revised and corrected to suit the present state of the building trade, by Mr George R. Burnell. The chief alterations effected, are—a revisal of the day work prices throughout; the omission of the prices for terro metallic goods, the fact of their being so seldom used having induced the author, very properly we think, to expunge them to make room for other matter of more importance; a partial revisal and alteration of the detailed prices or carpenters' and joiners' work; a revisal of the prices of ironmongery; a similar revisal of the prices for masons' work; the introduction of a new series of prices for gas fitters' work, and a general condensation of the text.

The contents embrace—excavator and well-diggers' work; bricklayers' work; carpenter and joiners' work; joiners' work; ironmongers' prices; masons' work; slaters' work; plasterers' work; glaziers' work; painters' work; plumbers' work; smith and founders' work; bell hangers' work; zinc workers' prices; gas fitters' prices; paper hangers' prices; paviors' work; asphalt and lava work; pozzolano work; felt, &c., with prices of coal tar, tar brushes, kettles, buckets, clout nails and scupper nails, leather straps and hose, wrought iron screwed tubes, wire ropes and copper cords for all purposes, india-rubber articles; contractors' tools, under which head are noticed cranes and crabs of all kinds, railway turntables, and shovels and spades for every purpose required by contractors. A table of the various sizes of Gwynne & Co.'s patent centrifugal pump, showing in a clear and concise manner the diameter of discharge pipe for each number or size of pump; diameter of suction pipe; horse-power to work the pump 30 feet high; gallons of water raised per minute, and the price of each pump, also the places and purposes for which each class of pump is especially applicable; and lastly, the prices of steam engines from two horse-power upwards.

An appendix to the work contains a series of tables, many of which are almost indispensable to the builder and contractor. We find in this part of the work a "parallel of French and English scales," which will be of great assistance to the draughtsman. These tables are succeeded by numerous notes and memoranda on the various trades referred to in the body of the work, and the whole is rendered complete by a carefully arranged alphabetical index, which enables any item to be instantly referred to without any trouble. It is needless for us to say that a work like the present should be in the hands of every builder and contractor.

The Engineers', Architects', and Contractors' Pocket-Book for 1861. 428 pp. 8vo. Lockwood & Co.

The Engineers', Architects', and Contractors' Pocket book, has now become a standard work of reference, although it has defects which might easily be remedied. We do not refer to the correctness of its tables and formulæ, these, so far as we have examined them, are surprisingly free from error, considering the large and diversified collection contained. Our remarks apply more to the selection of matter for such a work. We think a little careful pruning might be effected without depreciating the practical utility of the work, whilst space would be left for other matter of more general utility to the class for whom it is intended. For example, we think the "ephemerides of the planets for Greenwich mean time," might be omitted, references thereto being hardly of sufficient frequency, we should imagine, to warrant the introduction of those tables into a pocket vade-mecum like the present. The paper "on the present state of the arts of the manufacture of iron, with some remarks upon the iron trade of Great Britain, and upon iron plated ships, and upon iron wire bridges," is certainly better suited to the pages of some of our numerous scientific periodicals, than of a pocket-book. The short biographical memoirs given under the head "obituary of eminent engineers and architects for the years 1859 and 1860," occupy eleven pages of space which might be more usefully filled. The scientific societies are, on the contrary, neglected, with the exception of the Institute of Civil Engineers and British Architects. A work like this should contain a list of all scientific societies of any public note, with the names of the chief office-bearers, and addresses of their secretaries. New societies are fast springing up around us, and where should we refer for information concerning them, if not to the pages of the engineers' pocket-book. We find this year the usual amount of useful tables and general information which render this work so valuable to those for whom it is compiled, whilst the important addition of the "memorandum book of Mr Telford," embracing notes on mechanics, air, water, steam-engines, timber, iron, strength of various substances, arches of masonry, and miscellaneous articles, will be prized by most readers.

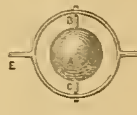
MECHANIC'S LIBRARY.

Analysis, Manual of Qualitative, 3d edition, post 8vo, 5s. Galloway.
Animal and Vegetable Substances, 2d edition, fcap. 8vo, 2s, cloth. Dexter.
Amusements, Scientific, and Recreations, fcap. 8vo, 1s 6d. Pepper.
Arithmetical Plan, New, 12th edition, 18mo, 1s, cloth Guy.
Arithmetical Questions, Answers to, new edition. 3s 6d. Throwrer.
Chemistry, Threshold of, post 8vo, 4s, cloth. Heaton.
Creation, Six Days of, 4th edition, 8vo, 3s 6d, cloth. Rhind.
Engineering, Civil, Encyclopædia of, new impression, 42s, cloth. Cresy.
Experiments, Handbooks of, 12mo, 1s, cloth. Cassell.
Locks, Treatise on Gunpowder Proof, &c., 8vo, 2s, cloth. Price.
Manufactures—Cotton—Bohn's Scientific Lib., vol. I., 5s, cloth. Ure.
Map Book for Beginners, 4to, 2s 6d, col. Cornwell.
Mathematics, Elementary Course of, 8vo. 12s, cloth. Young.
Medicine, Principles of Forensic, fcap. 8vo, 10s 6d, cloth. Guy.
Microscope, The, its History and Construction, 5th edition, 6s. Hogg.
Natural History, Illustrated, new edition, fcap. 8vo, 6s, cloth. Wood.
Power, Search for, Self-Motive, or Perpetuum Mobile, 10s 6d, cloth. Dircks.
Sciences, Circle of the, new edition, vol. II , crown 8vo, 5s, cloth.
Surveying, Subterraneous, Fenwick's, 3d edition, 2s, cloth. Weale.

CORRESPONDENCE.

THE ROTATION OF BODIES ON THEIR AXES.

Mr White, of Easdale, in attempting to prove the revolution of the moon upon its axis, refers to the crank pin of the steam engine, which may be distinctly seen to turn on its axis in the brasses of the connecting rod. Last February I recited a similar instance:—"Let a mariner's compass travel in a circle, and let one side of its case be always presented to the centre of that circle, in one revolution the needle will have pointed to every side of the box."



Mr Mitford cleverly intimates that the revolutions are apparent and deceptive, on the ground that a body cannot rotate "upon two axes at right angles to each other at one and the same time"—a manifest impossibility, when the axes themselves are in a state of rest; but if the slightest motion be given to one of them, as in the illustration to which Mr Mitford refers, there are two axial rotations at right angles to each other, which is proved by the following example:—

Let the ball, A, rotate upon its axis, B C, and let the axis, B C, together with the ball, A, revolve with the axis, D E, and the ball, A, does "rotate upon two axes at right angles to each other at one and the same time."

Mr Davidson, of Edinburgh, advises Mr White to grasp the crank-pin of the steam engine with the hand, and set it in motion, "the shaft will soon make him feel that it is the axis of the pin's motion, and thus his sense of feeling will correct his sense of vision." I doubt whether the sense of sight be not as trustworthy as the sense of feeling; but let any one keep his finger on one place near the circumference of a revolving disc, and he will not only see, but feel, the part he is touching twisting beneath his hand.

As a palpable and visible axial rotation was produced in my illustration of February last, in which every part of the rim of a circular box passed in succession beneath the points of a motionless magnetic needle placed across its mouth, and as the whole question which has occupied so much of your space may be made to rest upon that illustration, I think that nothing has yet been brought forward to prove the rotation there produced to be an illusion.

W. H. Harrison.

Haverfordwest, South Wales, March, 1861.

The letters of your correspondent, Mr Cameron, in the last two numbers of your valuable magazine, upon the "Expansion of Metals, Fluids, and Vapour," have afforded me much gratification. It is seldom that we find matters—so important as these are to every person interested in steam power and its economy—treated in the manner adopted by Mr Cameron.

Commencing his inquiries far back in the laws of matter, he gives us some well-defined principles to rest upon, and his method of research is easily understood. He does not ask us to believe in speculative theories, as numerous and as various as are the writers upon the subject, but all his interesting investigations are clearly and practically demonstrated. Many scientific minds, abroad and at home, are engaged in the study of some department of the same subject, and Mr Cameron must expect to be assailed by those who, differing from him in opinion, are so wedded to their own theories as to find fault with all persons who do not think as they do. I hope that Mr Cameron, keeping in view those clear and well-defined principles with which he sets out, will continue his researches, and I have no doubt he will arrive at practical results of no small magnitude. I am warranted in this from the character of his mathematical and magnetical writings; and I think, notwithstanding the letter of your Liverpool correspondent, C. W. Williams, that Mr Cameron understands the subject, and that it is safe in his hands.

W. C.

Glasgow, 21st February, 1861.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

JANUARY 18, 1861.

"On the action of gases and vapours on radiant heat," by John Tyndall, Esq., F.R.S. The discourse commenced by a reference to the researches of Leslie, Forbes, and Knoblauch; but more especially to the admirable investigations of Melloni on radiant heat. These eminent men had left the gaseous form of matter practically untouched, and to extend our knowledge into this wide region was the object of the investigation on which the present discourse was founded. The apparatus made use of, and which was applied in the experiments of the evening, consists of the following parts:—

1. A copper tube, C, containing water kept constantly boiling, and one ot whose faces, coated with lamp black, forms the source of radiant heat.

2. A brass tube, 2·4 inches in diameter, which is divided into two portions, A and B. A, the portion of the tube intended to receive the gases and vapours; it is stopped air-tight at its two ends by plates of rock salt, and is attached to a good air-pump, by which it can be exhausted at pleasure. The length is four feet. B, an air-tight chamber between the tube, A, and the cube, C. It is kept constantly exhausted, and the calorific rays therefore pass from the radiating plate through a vacuum into the tube, thus retaining the quality which belonged to them at the moment of emission. To prevent the transmission of heat by conduction from the cube, C, to the tube, A, the chamber, B, is partly embraced by an annular space, in which cold water continually circulates.

3. A thermo-electric pile furnished with two conical reflectors, and connected with an excellent galvanometer. One of the faces of the pile receives the rays which have passed through the tube, A.

4. A second copper tube, C', also filled with boiling water, and whose rays fall upon the second face of the thermo-electric pile. The two cubes, C and C', thus radiating upon the opposite faces of the pile, tend, of course, to neutralise each other. Between the cube, C', and the adjacent face of the pile, a screen, S, is introduced, being attached to an apparatus of Ruhmkorff's, capable of extremely fine motion; by the partial advance or withdrawal of this screen, the two sources of heat can be caused to neutralise each other perfectly. The tube, A, and the chamber, B, being both exhausted, the needle of the galvanometer is brought exactly to zero by the means of the screen, S. The gas or vapour to be experimented with is now admitted into the tube, A, and if it possess any sensible absorbing power, it will destroy the previously existing equilibrium. The consequent deflection of the galvanometer, properly reduced, is the measure of the absorption. In this way, the action of eight gases and thirteen vapours have been examined, and also the action of atmospheric air.

Oxygen, hydrogen, nitrogen, and atmospheric air, respectively absorb about 0·3 per cent. of the calorific rays—this is the feeblest action which has been observed. The most energetic action is that of olefiant gas, which at the tension of one atmosphere absorbs 81 per cent. of the calorific rays. Between those extremes stand carbonic oxide, carbonic acid, nitrous oxide, and sulphuretted hydrogen. Below a certain tension, which varies for different gases, the amount of heat absorbed is exactly proportional to the density of the gas. Above this tension, the rays on which the principal absorptive energy is exerted, become gradually exhausted, so that every augmentation of density produces a diminished effect. In the case of olefiant gas, for example, where a unit measure $\frac{1}{30}$th of a cubic inch in capacity was made use of; for a series of fifteen such measures, the absorption was exactly proportional to the quantity of gas; subsequently, the ratios of the successive absorptions approached gradually to equality. The absorption produced by a single measure of olefiant gas of the above volume, moved the index of the galvanometer through an angle of 2·2 deg.; the tension of the gas being only $\frac{1}{11000}$th of an atmosphere. In the case of vapours, the most energetic is that of sulphuric ether; the least energetic is that of bisulphide of carbon. Comparing small volumes and equal tensions, the absorptive energy of sulphuric ether vapour is ten times that of olefiant gas, and ten thousand times that of oxygen, hydrogen, nitrogen, or atmospheric air. Oxygen obtained from the electrolysis of water exerted four times the absorptive energy of the same substance when caused to pass through iodide of potassium, the greater action being due to the presence of ozone.

The radiative power of gases was examined by causing them to pass over a heated sphere of metal, and ascend in a column in front of the thermo-electro pile; various precautions were taken to secure accuracy in the results. It was found that the order of radiation was exactly that of absorption; that any atom or molecule which is capable of accepting motion from agitated ether, is capable, in precisely the same degree, ot imparting motion to still ether. Films of gas on surfaces of polished metal were found to act like coats of varnish.

In the foregoing experiments *free* atoms and molecules were dealt with, and upon them individually was fixed the responsibility of the effects observed. These effects are thus detached from considerations of cohesion and aggregation, which suggests themselves in the case of liquids and solids.

The reciprocity of absorption and radiation is a simple mechanical consequence of the theory of an ether.

But why is one molecule competent to stop or generate a calorific flux, so much more powerfully than another? The experiments prompt the following reply:—The elementary gases which have been examined, all exhibit extremely feeble powers, both of absorption and radiation, in comparison with the compound ones. In the former case we have oscillating atoms, in the latter oscillating systems of atoms. Uniting the atomic theory with the conception of an ether, it follows that the *compound* molecule which furnishes *points d'appui* to the ether, must be capable of accepting and generating motion in a far greater degree than the single atom, which we may figure to our minds as an oscillating sphere. Thus oxygen and hydrogen, which, taken separately, or united mechanically, produce a scarcely sensible effect, when united chemically to form oscillating systems as in aqueous vapour, produce a powerful effect. Thus also, nitrogen and hydrogen, which, when separate or mixed, produce but little action, when combined to form ammonia, produce a great action. So also nitrogen and oxygen which when mixed as in air, are feeble absorbers and radiators, when united to oscillating systems, as in nitrous oxide, are very powerful in both capacities. Comparing small volumes and equal tensions, the action of nitrous oxide is 250 times that of air; a fact which perhaps furnishes a stronger presumption than any previously existing, that air is a *mixture*, and not a compound. Carbonic oxide is about 100 times as powerful as its constituent oxygen; carbonic acid is 150 times as powerful, while olefiant gas, as already remarked, is 1000 times as powerful as its constituent hydrogen. In the case of the hydro-carbon vapours, where the atomic groups attain a higher degree of complexity, the action is even greater than that of olefiant gas.

With regard to conduction, the speaker would illustrate his views by reference to two substances—rock-salt and alum. He was once surprised to observe the great length of time required by a heated mass of rock-salt to cool; but this was explained by the experiments of Mr Balfour Stewart, who shows that rock-salt is an exceedingly feeble radiator. The meaning of this is, that the molecules of the salt glide through the ether with small loss of *vis viva.* But the ease of motion which they are thus proved to enjoy, must facilitate their mutual collision. The motion of the molecules, instead of being expended on the ether between them, and then communicated in part to the ether external to the mass, is transferred freely from particle to particle; or, in other words, is freely conducted. This *à priori* conclusion is completely verified by the author's experiments, which prove rock-salt to be an excellent conductor. It is quite the reverse with alum. Mr Balfour Stewart's experiments prove it to be an excellent radiator, and the author's experiments show it to be an extremely bad conductor. Thus it imparts with ease its motion to the ether, and for this very reason finds difficulty in transferring it from particle to particle; its molecules are, in fact, so constituted, that when one of them approaches its neighbour, a swell is produced in the intervening ether—this motion is immediately communicated to the ether outside, and is thus lost for the purposes of conduction. The lateral waste prevents the motion from penetrating the alum to any great extent, and hence it is pronounced a bad conductor. These considerations seem to reduce the phenomena of absorption, radiation, and conduction to the simplest mechanical principles.

FEBRUARY 15, 1861.

"On English poetry in reference to music," by Henry F. Chorley, Esq.

FEBRUARY 22, 1861.

"On platinum," by Professor Faraday, D.C.L., F.R.S.

Wherever platinum occurs, it is usually, if not always accompanied by five other remarkable metals, namely, Ruthenium, Osmium, Iridium, Rhodium, and Palladium; and, in addition, by other substances, as iron, copper, gold, silver, and sand. Being washed, the heavy particles are left as the general ore of platinum; this metal constituting by far the largest part of the substances.

The platinum has usually been obtained from these ores (after they have been well washed, sifted, and mechanically separated) by the action of nitro-muriatic acid, which, bringing the platinum into solution, supplies a fluid which, on the addition of muriate of ammonia, &c., throws down a precipitate of ammonio chloride of platinum. This washed, dried, and heated, gives spongy metallic platinum; which being then pressed, heated, and hammered, yields massive platinum; the agregation of the particles taking place entirely by adhesion and welding. Instead of forming a solution by acids, Deville proposes to employ a heat fluxion process; and instead of welding, to fuse the metal together at the last, by intense heat, obtained by the use of the oxy-hydrogen or the oxy-coal-gas blowpipe. The ore, properly prepared, is mixed with its weight of galena or native sulphuret of lead, and half its weight of metallic lead; it is then heated and well stirred together, the iron and some other metals are taken up by the sulphur of the galena, the platinum and other metals are taken possession of by the lead, and when the action is well effected, the access of air is adjusted until the remaining part of sulphuret is decomposed, and only platiniferous lead left at the bottom part of the crucible or furnace, with scoriæ upon it. The former is separated, and then heated, exposed to air until much of the lead is oxidized; which, escaping as litharge, leaves at last an alloy of lead and platinum, containing not more than ten or even five per cent of lead. Such an alloy of platinum requires a very high temperature to fuse it, and this is therefore attained and applied in furnaces constructed of chalk lime, heated by the insertion of gas blow-pipes. The heat first melts the alloy, and being combined with oxygen in a little excess, the remaining lead is rapidly oxidised and dissipated in fumes, and then being raised and continued, any gold, copper, osmium, or other metals, except iridium and rhodium, are also converted into vapour and driven off. The platinum remaining is at last heated to a still higher degree, and is either cast into flat cakes or granulated, and this has been done with quantities weighing even as much as 40 lbs.

INSTITUTION OF CIVIL ENGINEERS.

December 4 & 11, 1860, and January 8 & 15, 1861.

The discussion upon Mr W. H. Preece's paper, "On the maintenance and durability of submarine cables in shallow waters," occupied four evenings.

It was thought that the chief points for discussion were, the necessity of thoroughly surveying the route before laying a cable, the important question of the insulating medium, and of applying some exterior protecting coating, not only to cables intended for shallow water, but also for those to be laid in deep seas. The neglect of this latter precaution had, it was believed, been the cause of the recent failures in deep sea cables, which had been found to be decayed and rotten when attempted to be lifted for repairs. The cable laid between Toulon and Algiers was believed to be nearly the true form for deep seas, and if combined with the Red Sea cable, the desired form would then almost be produced. One of the principal causes of the failure of telegraph cables was their not being thoroughly tested under water, until they were deposited in the ocean. When the Red Sea telegraph was laid, it proved, like most lines just completed, very successful. It was stated to have been worked from Alexandria to Aden, at the rate of ten words per minute, with double relay stations at Krossier and Suakin. There were a few embryo faults, but it was thought that it might have been worked successfully, for a considerable time, if a permanent system of daily tests, and of timely repairs had been established. There were other destroying agencies besides those which had been alluded to, such as excessive tropical heat, and the effect, upon the cable, of metallic veins at the bottom. The sections of the Red Sea cable had lasted altogether for nine months before the first fault occurred, having only given way the day before the Indian extension was completed. It had been originally intended, that the cable should never leave the water, that it should be kept in tanks during the process of manufacture, and be paid out from tanks into the sea. As, however, the tanks could not bear the great pressure, the cable became exposed to atmospheric influences. It was soon observed that there was a decrease of insulation, indicating a considerable increase of temperature. Subsequently this became so great, that it was necessary to test the temperature of the coil of cable in every part. For this purpose, a peculiar thermometer was used, constructed upon the principle of the resistance of copper wire to the electric current, or tube of metal. In coiling the cable on board, several of these thermometers were inserted at different layers of the coil. When tested, after being on board only one week, it was discovered that a spontaneous generation of heat had taken place, and that the heat developed itself unequally throughout the mass, the highest temperature being about three feet below the upper surface of the coil. A large quantity of water, at a temperature of 42 deg. Fahrenheit, was poured upon the cable, and this was observed to issue from the bottom of the hold at 72 deg Fahrenheit. This occurrence seemed to show that other cables, more particularly the Atlantic cable, which had been coiled on board wet, might have been ruined from the same cause. If the heating had been allowed to continue a few days longer, the gutta percha would have been softened, and the copper conductor would have become eccentric to the insulating material. It was considered probable, that this generation of heat was due to fermentation of the hemp covering, whilst it had also been attributed simply to the rusting of the iron.

It frequently happened, in repairing a cable, that on the surface of the gutta percha there was found a small lump, a little hole, or a piece blown out, as if burnt by a flash of lightning. The effects had been, erroneously it was maintained, attributed to lightning. On the other hand it was contended that the great enemy in the working of the cable, was ozone. When the smallest puncture admitted the least drop of water in connection with the cable, the decomposition which took place generated ozone, which was known to attack in a rapid manner, all inorganic substances like india-rubber or gutta percha. As to the comparative merits of india-rubber and gutta percha as insulating materials, the electrical qualities of the former had been proved to be far superior to the other, and the only thing wanting to justify the use of india-rubber for long deep sea cables, was positive proof of its durability. Now, the submarine cables laid in 1852 for connecting Hampshire with Hurst Castle, and also crossing Yarmouth river, in the Isle of Wight, were coated with india-rubber, which was now as durable and as good as when first laid down. There was no reason why cables should not be taken up, examined, and repaired periodically; and it was believed that submarine telegraphy would shortly have arrived at that state, when it would be possible to preserve the communication uninjured for an almost indefinite period.

January 29, 1861, and February 5 and 12, 1861.

The discussion upon Mr Braithwaite's paper, "On the River Wandle, its Springs, Tributaries, and Pollution," occupied three evenings.

February 19, 1861.

"On the results of trials of varieties of iron permanent way," by Mr F. Fox.

February 26, 1861.

The evening was occupied by the discussion upon Mr Fox's paper "On the results of trials of varieties of iron permanent way."

March 5, 1861.

"Description of a pier erected at Southport, Lancashire," by Mr H. Hooper.

"On the construction of floating beacons," by Mr Bindon B. Stoney. The various forms of floating beacons hitherto employed were first referred to, including, among those whose axis of symmetry was horizontal or oblique, the barrel and the can buoys; and among those whose axis of symmetry was vertical, of which the cone might be considered the typical form, the bell beacon of Liverpool, the nun buoy, and the egg-bottomed buoy. Being aware that additional keels, or bilge-boards, tended to prevent ships of certain forms from rolling, by the inertia of the mass of water constrained to move along with the ship, and that advantage had been taken of this circumstance in some light-ships, the author suggested that a similar arrangement might be applied to a floating beacon, and the result was the keel buoy. The superstructure might be of any of the ordinary forms, the dome-shape being preferred for conspicuousness. The sides were prolonged below the bottom, so as form a circular keel, within which a large body of water was contained. Thus, a buoy six feet diameter, and with a keel eighteen inches in depth, would contain a mass of water weighing about one ton, or the same weight as the buoy. The bolt of the mooring chain, where it passed through the mooring ring, divided the surface exposed to lateral pressure into equal, or nearly equal portions. Hence, the keel buoy would float erect in tideways or river currents. as an equal pressure was exerted both above and below the centre of mooring. The keel also gave this buoy a greater hold in the water, and the tendency to pitch was diminished. It also acted as ballast placed in the best position to secure stability. In consequence of the peculiar form of the keel buoy, and of its stability, the superstructure might be 25 per cent. higher than that of other buoys of equal diameter, with the same configuration above the water. The mooring ring had a shank which projected through an aperture in the wrought iron bottom. It was firmly riveted on the inside of the bottom, so that the straining of the chain could not tear it away, or loosen the rivets. The author believed, that in the keel buoy there was a greater freedom from abrupt motion than was possessed by other floating bodies having the same amount of displacement. If a buoy was made very wide in proportion to its height, and with slight immersion, it would float upright, because it would float like a board on the surface of the water; but stability thus gained would be at the expense of manageableness. If, on the other hand, stability was sought for. not by breadth of beam, but by ballasting the bottom, the buoy would not only be unwieldy, but expensive. The keel buoy was light, was easily handled, and, on board ship, only occupied so much room as was sufficient for it to stand on end; thus contrasting favourably with the can and egg-bottomed buoys.

PHILOSOPHICAL SOCIETY OF GLASGOW.

January 30, 1861.

Remarks upon the fall of rain in the districts supplying Glasgow with water, by James M. Gale, C.E.

Report of the temperature and rain-fall, &c., of the year 1860, observed at Cessnock Park, by Mr Robert Hart.

February 12, 1861.

On the stalactitic sulphate of barytes found in Derbyshire. by Walter Crum, F.R.S.

On street railways, by T. Currie Gregory, Esq., C.E.

The rails used by Mr Train are an improvement upon the latest form adopted in America. They are made of rolled iron, and are flat, with a ridge on the one side of about three-fourths of an inch elevation, with a slightly rounded crown of about one and a-half inch broad, vertical on the outside and worked off into a round and hollow in the inner side, leaving a lower flat surface of about four and a-half inches broad, upon which the wheels of ordinary vehicles can run.

Many different kinds of rails have been used in America; many of them with a groove for the flanged wheel to run in, but none, till lately, intended to accommodate also the general traffic. The groove is very objectionable, inasmuch as the wheels of carriages are apt to get into it, and, when this happens, they are turned out with difficulty, and are often seriously injured, if not wrenched off. The groove also is apt to get filled up with small stones and mud, and in the winter time with snow, which gets compressed, and these obstacles often cause the cars to run off the rails. No such contingency need be feared in the case of the rail laid in this country. The rails, laid to the same gauge as the steam railways, 4 ft. 8½ inches, are firmly bolted to longitudinal sleepers, which again are secured to cross beams. The whole is firmly bedded in gravel, and the paving between is neatly laid to suit the horses' feet, while the causeway on each side of the track is laid close up to and flush with the top of the ridge.

The improved cars, constructed expressly for this system of railway, are formed with an oblong body, the whole of the upper part of the sides of which have a series of glazed sashes or windows, the lower portion of which can be opened by sliding the sashes upwards, and are fitted with framed venetian blinds, which, when not in use, slide into recesses below the window frames. Each end of the body of the carriage is provided with a sliding door, for admission into the interior of the vehicle from a platform, which is on a level with the floor of the car, and is reached by steps on the sides of the platforms, so that the vehicle can be entered from each side at both ends. The roof is extended over the platforms at each end, and is fitted with seats, which are gained from the platforms at the ends of the car. A bell is fitted to each end of the roof of the car, and warning can be given by any passenger by the pulling of a rope which extends along the length of the car. The body of the car is mounted upon two pairs of flanged wheels provided with suitable springs. The brakes are formed by a system of rods and levers, which can be worked from either or both platforms by the driver, conductor, or both, and are so arranged as to act on all the four wheels of the car at one time. The cars are intended to travel either end first, the horses being attached thereto in such a way that they can be immediately disconnected, with their harness, pole, and so forth, from either end, and re-attached at the other. The cars are most commodious, and, as run at Birkenhead, are seated for 24 inside and 24 outside. They are 7 feet high, and are so wide that, when the seats inside are occupied, there is room for two rows of persons to stand in the passage. In an emergency, 20 can find standing room. The cars can be made any size, and in New York some of them carry 100 persons.

It is not intended to appropriate any portion of the streets, and prohibit any other vehicles from running on the trackway of the railway cars. Leave is simply asked to lay rails, such as already described, either in a single or double track, according to the width of the streets, up the centre of the carriage way generally, with the right of running omnibuses with flanched wheels thereon. These rails will not in any way interfere with the ordinary traffic, which can run upon, cross and recross them without difficulty. They have no groove to lock the wheels of waggons, and, instead of offering any obstacles, present great advantages, as is shown by the readiness with which drivers avail themselves of the flat part of the rail to relieve their horses, and increase their speed.

Any street of 25 feet width between the kerbstones, and upwards, is amply wide enough for a single track. The cars are 7 feet outside, and, if room be allowed on each side for lorries to stand at shop doors, nothing more is required. Take 7 from 25 and there remains 18, or 9 feet on each side clear while the car passes. The cars proceed singly, like any other omnibus, and occupy the ground only as they pass over it.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

January 15, 1861.

"On the Equitable Adjustment of Property and Income Tax, and the Extent to which it is Practicable to Apply such Tax," by Mr David Chadwick, F.S.S.

February 18, 1861.

Letters were read from Captain Andersen, R.M.S. "Canada," and from Dr Wallich, respecting the pamphlet on "Life in the Deep Seas."

Mr Sidebotham described his experience in mounting desmidiæ, and the difficulty he found in discovering a suitable medium for their preservation. He had tried syrup, Goadby's fluid, and a number of other chemical preparations, but the specimens, in course of time, were spoiled from one cause or other; the fluid which has best withstood the effects of time is simple distilled water; the cells being made of gold size and Japan black. Mr Sidebotham exhibited desmidiæ, mounted in distilled water, in the years 1842 to 1846, in which the chlorophyll is comparatively little altered.

Professor Williamson observed that Dr Carpenter had mounted starfishes in glycerine, and had found the colours were well preserved. He himself had used a mixture of glycerine and distilled water for volvox, and had found it to answer well.

Mr Sidebotham also exhibited specimens of diatomaceæ, mounted in 1844. The specimens (Isthmia enervis, Biddulphia, &c.) were obtained fresh, immersed in spirits of wine to absorb the water, and mounted in balsam; the green colour of the cell contents is yet perfectly preserved.

Professor Williamson exhibited some scales of fish, prepared by Dr Kölliker, of Warzburg, containing remarkable examples of fusiform lacunæ. He also pointed out how these and other similar discoveries, to which he referred, confirmed his previous conclusions in the philosophical transactions, viz., that fusiform lacunæ were not characteristic of reptilian bonds, as some had supposed, but that they existed in many fishes; he especially referred to the salmonidæ as presenting this oblong form of bone corpuscule.

Mr Brothers exhibited a modification of the kaloscope, and objects to illustrate the same.

February 19, 1861.

"Brief Notes on the Freezing, Thawing, and Evaporation of Water, and on the Condensation of Steam, with a View to Enquire into the Cause of those changes," by J. C. Dyer.

The author submitted that the *only solution*, hitherto offered of the *absorption* of sensible heat, in water and steam, as latent in these, and the re-appearance of the same *measure* of heat, in a sensible state, by the acts of condensation and freezing, is to be found in the application of Dr Black's "Latent Heat Theory." Considering the *force heat theory*, as directly conflicting with that of *latent heat*; they cannot both be sustained, and as the latter stands in elementary works as an established law in physics, and as it affords a clear explanation of the aqueous changes adduced; it seems incumbent on those who deny the entity of *heat*, to account for the alternate exhibition and extinction of the thermometric heat, that *is*, in fact, evolved and absorbed by those mutations of water.

"On the Production and Prevention of Malaria," by Dr. R. Angus Smith.

As we can imitate malaria of some kinds, so can we also imitate the methods by which nature prevents it. The warm alkaline soil, moistened, and washed with air and water, becomes acid, it sends forth less volatile matter—decomposition is stopped to a great extent, the matter is preserved. Cold prevents the action, drainage assists oxidation by a more active state of soil. By these modes, and others, the soil is disinfected by nature; when these do not act sufficiently we may use disinfecting agents. By their means decomposition may be interrupted without fear of diminishing the power of the plant to take up food. By the use of disinfecting agents, Mr M'Dougall had been able to feed sheep and cattle, and retain them in health, on meadows constantly wet by irrigation with liquid manure. The disinfectant used is from the products of the distillation of tar, the amount required is small. Animal life is rapidly destroyed by it, and chemical decomposition is staid. All climates can furnish this, where coal lies or where trees grow.

It would be possible to irrigate great districts at an extremely small expense. The result would be as certain on a large scale as on a small one; and it is probable that, in some cases, one or two applications would be sufficient, for a long period at least. By the new state of things, destructive insects would also be destroyed. Although, according to Dr M'Culloch, there are many parts of our own islands infected by malaria, most, if not all, can be cured by good attention to well-known agricultural maxims. This new method is especially applicable to other countries, and to more violent stages of the disease. The author hopes to have it tried on extensive districts in Italy. The method arose out of an advice everywhere neglected, but still cherished as true, to disinfect whole cities by beginning with the sewers, the origin and reservoir of all the mischief.

The author believes that he has shown that decomposition, to a most pernicious extent, is possible in soils, that this is not a mere opinion, but a fact readily demonstrated; but that decomposition may be arrested artificially to the preservation of health without the destruction of vegetation, and that in these facts we have not only a surer basis in our reasonings on the origin of malaria, but an almost certain process for its ultimate and total extermination.

February 28, 1861.

"On the irregular oscillations of the barometer at Manchester," by Mr G. V. Vernon, F.R.A.S.

"On the irregular oscillations of the barometer at Lisbon," by Mr Baxendell, F.R.A.S.

Mr Atkinson exhibited a chart, showing at one view the barometric oscillations during the present month of February, as observed by him at Thelwall, and also the strength of the wind, corresponding to each observed altitude of the barometer.

Mr Mosley read an extract from the *Gibraltar Chronicle*, of the 11th February, 1861, giving details of a violent gale experienced at that place, and on the coast of Morocco, on the 9th of February.

March 5, 1861.

"On the structure of the luminous envelope of the sun," being a communication from James Nasmyth, Esq., of Penshurst, by Mr Joseph Sidebotham.

Mr Nasmyth has made the discovery, that the entire surface of the sun is composed of objects of the shape of a willow leaf; these objects average about 1000 miles in length, and 100 in breadth, and cross each other in all directions, forming a network; the thickness of this does not appear to be very great, as through the interstices the dark or penumbral stratum is seen, and it is this which gives to the sun that peculiar mottled appearance so familiar to observers. These willow leaf-shaped objects are best seen at the edge of a solar "spot where they appear luminous, on a dark ground, and also compose the bridges which are formed across a spot" when it is mending up; the only approach to symmetrical arrangement is in the filaments bordering the spot, and those composing the penumbera, which appears to be a true secondary stratum of the sun's luminous atmosphere; here these bodies show a tendency to a radial arrangement. Although carefully watched for, no trace of a spiral or vertical arrangement has been observed in these filaments; thus setting aside the likelihood of any whirlwind-like action being an agent in the formation of the spots, as has been conjectured to be the case.

"On changes of density which take place in rolled copper by hammering and annealing," by Mr Charles O'Neill.

The results of his experiments proved that the best commercial rolled copper actually lost density by hammering instead of gaining, as might have been anticipated. In the first series of experiments, ten pieces of copper were cut from a sheet of the thickness of $\frac{3}{16}$ inch, the pieces weighed from 250 to 320 grains each, their mean density was 8·879. The pieces were then separately subjected to the action of a powerful compressing machine, acting on the principle of the *genou*, about fifty blows being given. The density of these hammered pieces showed a mean of 8·855, being a loss of 0·024. The same pieces were annealed by being placed in red hot sand, and cooled slowly; when cleaned from adhering oxide, the mean density was found to be 8·884, being an increase of 0·029 on the hammered pieces, and 0·005 on the original pieces. A second series of experiments, made with very great care, corroborated the first in the main points. The pieces were from another and better sheet of copper; ten pieces, weighing each from 420 to 520 grains, showed a mean density of 8·898, being hammered by the same machine; their mean density became 8·878, showing a loss of 0·020 by hammering; upon annealing in a charcoal fire, the mean density of five out of the ten pieces was 8 896, showing a gain of 0·018 upon the hammered pieces, and a loss of 0·02 upon the original. A third series of experiments upon the change of density in a bar of copper by successive hammerings showed a loss of density from 8·885 to 8·867.

The author considered there was a connection between these phenomena and the heat disengaged in the hammering of the copper; he conceived it possible that the expanded state of the copper while heated by hammering was retained, and that the effect of annealing might be to allow the molecules or particles to recover the state in which they were in before being disturbed by the heat produced in hammering.

MARCH 27, 1861.

"On Scientific Philanthropy, or the Best Means of Promoting Social Reform," by Mr Thomas Ballantyne.

INSTITUTION OF NAVAL ARCHITECTS.

MARCH 1, 1861.

"On the deviation of the compass in iron and other vessels, considered practically with reference to material, position, and mode of construction and equipment," by F. J. O. Evans, Esq., R.N., Assoc. I.N.A., Superintendent of the Compass Department of the Admiralty. The author defined the nature of the laws of magnetic action in iron ships, for the purpose of clearing them, as far as possible, from mathematical obscurities. He next detailed the results of his own personal investigation of many hundreds of deviation tables, chiefly of H. M. ships, and classed under the following heads:—1. Sailing vessels wood-built; 2. Steam vessels wood-built; 3. Vessels built partly of wood and iron; 4. Steam and sailing vessels iron built; 5. Iron-plated ships. In the first class he found that the north end of the needle was almost invariably drawn to the ship's head, the amount of the action being small. In the second class the same general law obtained, but the machinery was found to add greatly to the disturbance, the direction of the magnetic force varying as the engines, boilers, &c., were variously arranged. In the third class, the iron is introduced in such a variety of forms and positions that only a general account of the magnetic action could be given. The compass errors produced are necessarily of a most uncertain and dangerous character, the more so as they are often unsuspected by the builder and navigator. The author instanced some very important modern examples illustrative of this view. With regard to the fourth class, the author explained that the great difference in the conditions of compass disturbance in wood and iron-built ships respectively is that, in iron vessels, during the progress of building the inductive action of the earth's magnetism is highly developed, and to a great extent fixed, by the repeated hammering in the riveting and other works in the general fabric. The hull consequently becomes one large magnet, divided into two portions (similar to a magnet bar), one portion having north and the other south polarity, or the power respectively of repelling and attracting the north end of a compass needle. He also drew attention to the fact that in two iron ships built in every respect similarly, except as regards the *quality* of the iron, the compass will be very differently affected, the softer iron being subject to the greater changes, and therefore the more likely to lead to disaster. From the same circumstance follows the very remarkable inference that if this iron be largely used in the construction of a ship, the delicately-poised needle of the compass will infallibly detect its presence. After an elaborate review of facts connected with the variation of the magnetism of iron ships, the author inferred that the greater the co-efficient denoting the deviation due to the *induced magnetism* of soft iron in a ship (known as the quadrantal deviation), the more rapid and capricious will be the change of the ship's magnetic force, both in direction and amount. And, conversely, with a small co-efficient, there will be little or no change in the direction, but a decrease in the amount of the magnetic force. "But we are warned," said the author, "under any circumstances, not to send an iron ship too quickly to sea after launching; that her equipment shall progress with her head if possible in an opposite direction to that in which she was built; and, as suggested by Mr Airy, to 'shake out' by motion, concussion, or the tremor of the steam engine the variable part of the sub-permanent magnetism." The author gave detailed statements on the best direction for building iron ships, and on the position of, and arrangements for, the compass. He urged the general adoption of the Admiralty standard or Azimuth compass in the mercantile marine, and gave directions for fitting it. In conclusion, the author briefly referred to iron-plated ships of war, pointing out the importance of due attention being given to the novel phenomena which must attend their action upon the compass, and inviting further practical investigation of the subject."

The importance of this question cannot be overestimated, if we take into consideration the sacrifice of human life and the immense loss of property which annually arises from the deviation of the compass. With Underwriters, iron ships are still a question of anxious concern, but we have every confidence, from the rapid advances that are being made in our knowledge of the science of magnetism, that the question of the deviations in ships' compasses will become perfectly understood and properly compensated for. So that the mariner will proceed to sea with the same confidence in an iron ship as he does in one built of the good old oak. To all interested in this important question there can be no doubt there is much room for improvement, and we cannot avoid the conclusion that, until iron ships can be navigated with as much safety as those of wood, that the business of iron ship-building will, to a certain extent, be retarded. Certainly no place in Great Britain would gain more by an unerring system of adjusting compasses for iron ships than the Clyde, and we shall be glad to receive communications from practical men on the subject.—ED. *P. M. J.*

MONTHLY NOTES.

MARINE MEMORANDA.

Scores of noble ships are laid up in ordinary in Portsmouth harbour—that is to say, are slowly rotting at their moorings. All are built of the best materials, "quite regardless of expense;" many are still as good as new, some have never even seen the blue water. Could not some of them be turned to account in that "reconstruction" of the navy which is coming? Suppose the sides to be plated with iron, the metal casing so formed might be prolonged fore and aft, so as to enclose a new and sharper bow in the one case, a longer stern, and one better fitted for the screw, in the other. We should thus gain greater length and increased speed, with undiminished buoyancy. The good old ship of oak would remain a water-tight compartment in the middle, while the working part at one end, and the striking part at the other, would combine that lightness and strength which are peculiar to boats of iron. A ship so converted would not certainly be equal at all points to the Warrior; but she might possess, in no very inferior degree, the principal requisites for Channel service—size, speed, a thick skin, and a heavy broadside. She might certainly be put out of hand in a much shorter time, and at a far smaller cost.

Some interesting experiments have just been made on the Tyne aboard a new steam vessel built by Messrs C. Mitchell & Co., of Low Walker, to test the effect of Rowan's patent in the economy of fuel aboard seagoing steamers. The vessel fitted with this patent is the Diamantina, a paddle steamer, completed for the Australian Steam Navigation Company; and the requirements by the contract were guaranteed speed, light draught of water, and economy of fuel. The vessel's dimensions are 153 feet long, 23 feet beam, and 5 feet draught of water. The engines, built by Messrs R. Stephenson & Co., are 60 horse power nominal, and the paddle-wheels have feathering floats. The following are the results of an experimental trip, made under the inspection of Mr Robert Bowman, the company's engineer. Registered results:—Average pressure of steam in boiler, 111·5lb.; vacuum in condenser, 26½ inches; speed of engine per minute, 32 revolutions; speed of vessel, nine knots per hour; consumption of fuel, 270lb. per hour. The vessel was subsequently tried for speed alone, and realized from 10 to 11 knots per hour.

Her majesty's paddle steamer Vivid has had a second trial of Mr D. K. Clark's patent apparatus for the prevention of smoke issuing from the chimney. Mr Clark's invention consists in introducing a supply of air into the furnace above the fuel by means of jets of steam. The operation of the jets during the trials is stated to have been attended with a falling off of indicated power to the extent of 62 horse power, being about 10 per cent. of the power worked up to by the Vivid, and a consequent reduction of speed from 13·17 to 12·95 knots, by a loss of nearly a quarter of a knot per hour. The consumption of fuel was scarcely affected, being in each case about the same. The plan of mitigating the nuisance of smoke, though somewhat favourable, is stated to be still imperfect. The effect of the apparatus, it appears, occasions a noise in the engine-room to some objectionable extent, but which it was suggested might propably be in a great measure remedied by the inventor.

We are glad to be able to render a good account of the shipbuilding trade on the Clyde. Messrs Simons & Co. have launched from their works at Renfrew an iron screw steamer of 450 tons, named the Moulmein, for the Calcutta and Burmah Steam Navigation Company. Messrs Thomson are building for Messrs Papayanni Brothers, of Liverpool, a screw of 2000 tons and 300 horse power, intended for the Liverpool and Mediterranean trade, a paddle of 800 tons and 350 horse power, for the Lancashire Steam Navigation Company, intended to trade between Liverpool and Belfast; and a screw of 600 tons and 150 horse power, for Messrs Hutcheson & Co., of Glasgow, intended for the West Highland trade. Messrs Smith & Rodger have on hand for Messrs Malcolmson, of Waterford, a steamer of 750 tons and 140 horse power, intended for the conveyance of cattle from Ireland to Great Britain; and a screw of 1200 tons and 160 horse power, intended for the Mediterranean trade. The Scotia, which Messrs Napier are constructing for the Cunard line, will be a paddle steamer of 4000 tons and 900 horse power. Messrs Napier are also building for the same line a steamer of 2550 tons and 450 horse power, and a river steamer for the Clyde of 200 tons. Messrs Barclay, Curle, & Co. have on hand a screw of 800 tons, with engines of 112 horse power, intended for the Leith and Baltic trade; an auxiliary screw of 1400 tons and 153 horse power, for the American trade; and a paddle river steamer for the Clyde of 224 tons. Messrs Tod & M'Gregor are constructing, for the Liverpool, New York, and Philadelphia Company, a screw of 2600 tons and 550 horse power; for the Glasgow and Liverpool Company, a screw of 880 tons and 150 horse power, intended for the Liverpool and Glasgow trade; a screw barge of upwards of 100 tons, for India; and a similar vessel of 20 horse power, to be used by Dr Livingstone in his African wanderings. Mr J. G. Lawrie is building a screw of 520 tons and 80 horse power, intended for the coasting trade. Messrs T. Wingate & Co. have on hand two steamers of 650 and 300 tons respectively, intended for the China trade. Messrs Stephen & Sons are also building a screw of 700 tons and 140 horse power, for the India trade. Altogether the Clyde builders are well employed.

A further official trial of the system of instantaneously disconnecting boats from their falls, on being lowered from a ship's davits on any sudden emergency, took place recently on board the steam tender Lucifer, at Portsmouth, in presence of Rear-Admiral Superintendent Hon. George Grey; Captains Moorman and Coote, of her Majesty's ships Cossack and Victory; and several other naval officers. The trials took place outside the harbour, and the boat was lowered three times with the most perfect success, so far as the inventor of the system pretends to go—the instantaneous freeing of the falls from the boat at the moment required by the person in charge of her. To obtain this result, the boat is fitted with an iron shaft running along the boat's kelson, and connected with an eccentric under the sternsheets; the latter, worked by a small hand lever, throws the shafting forward or aft as may be required. On this shafting, in a line with the boat's falls, are stout claws or teeth, immediately in front of each of which are stout metal rollers. From the after part of each roller run three-inch square casings, level with the boat's thwarts. The lower block of each fall has its hook prolonged into a stout bar, sufficient to reach the shafting in the bottom of the boat, and terminating in a semicircular link moving upon a stout iron pin. To hoist the boat up to the davits from alongside the bars attached to each block are passed down the casings until the semicircular links touch the bottom, when the lever, thrown forward by the hand of the man in charge of the boat, the claws of the shafting catch the links, and jamming each under its roller, it is locked by the eccentric in that position. A pin inserted abaft adds to its security. It will therefore be seen that to lower the boat, the falls having been cleared in the usual manner, and the crew having taken their seats, the lowering from the ship commences in the common way. The officer in charge of the boat, with his hand on the lever, has the power of freeing the boat from its falls at any moment he sees a fit opportunity, and releasing both ends of the boat at the same instant. In this certainty consists the merit of the invention claimed by the inventor, who does not prefer any claim to give the boat headway prior to clearing the ship, as in Clifford's plan. The invention is of a somewhat analogous character to the late Captain Kynaston's, whose disengaging hooks were also of a very similar character to those adapted for a like purpose, in 1833, by Lieut. Waghorn, the projector of the overland route, and which were fitted to the Levant, merchant steamer, and tested in Falmouth Harbour in the following year, in the presence of Capt. King, Superintendent of Packets, with the most perfect success. The system of lowering recently tried, however, professed to be, and certainly appears so, a more certain and instantaneous method than either Kynaston's or Waghorn's.

The Gun and Mortar Boats.—A return has been laid before Parliament purporting to give an account of all gun and mortar boats built by contract since 1852, though the list given contains only 226, and the select committee on gunboats stated that 286 had been so built between 1854 and 1857. The 172 gunboats here accounted for cost rather more than L.1,000,000. According to this paper some of them have required repairs to no greater amount than L.4, L.3, or L 2. If so, the difference in quality was remarkable indeed; for upon each of 17 of them, costing about L.5000 a piece, and launched only in 1856, there has been, or at the time of this latest but undated return was to be, above L.1000 laid out in repairs. Among them was the notorious Caroline, repairs, L.2125; the Mackerel, L.2248; the Pheasant, L.2164; and the Highlander, L.2066. But several of the gunboats are still only described as "ordered to be examined;" and of the mortar vessels almost every one not turned into a lighter yet remains unexamined. So the last of this story is still to come.

Palikari Steam Ship.—The engines of this vessel were built by Messrs T. Richardson & Son, of Hartlepool. The following are a few particulars as to the qualities, performance, and capacity of this steamer:—Tonnage, 1160 tons; draught of water, 14 feet aft, 10 feet 6 inches forward; diameter of cylinder, 45 inches; stroke, 27 inches; number of revolutions, 70 per minute; pressure of steam, 23lb; vacuum, 25¾ inches; indicated horse power, 638; consumption of fuel, 12 cwt. per hour. The speed attained during the trial trip was 11½ knots per hour; and the distance from Redcar Buoy to Hartlepool was run in 28 minutes. Mr Meacham, the Greek and Oriental Company's engineer, was present, to inspect the working of engines and boilers, and reported everything to be to his entire satisfaction. A select party, including the builders and engineers, with John Preston, Esq., from London, on behalf of the Greek and Oriental Company, were also on board during the trial. The engines and steam-jacketed boilers have superheated steam apparatus, and feed water, heated from exhausted steam from the cylinders. The boilers, and, indeed, all the exposed surfaces, are covered with felt and wood to retain heat; and it is thus, we understand, the great economy in heat, and consequently in power, is effected. This was to many an interesting subject of observation; and the light vapour from the chimney (showing the non-production of smoke and perfect combustion of fuel), was frequently remarked—strikingly contrasted as it was with the dense cloud from the tug steamer in attendance.

The revenue account of the Great Western lines for the half-year ending the 31st of December last, showed that L.894,081 had been received for traffic, L.6750 from the Bristol and Birmingham company for rent, L.9606 for the use of plant by other companies, L.3263 for interest on cash balances of revenue, L.4887 for rent of the Great Western Hotel and other estate, cottages, &c., and L.298 for registration fees, making the total receipts for the half-year on revenue account £918,886. The expenditure amounted to £365,249, or 40·85 per cent. of the receipts, including L.18,882 for passenger duty, L.16,112 for rates and taxes, L.3500 towards liquidation of Parliamentary and legal expenses, L.2000 reserve for doubtful debts, L.1500 reserve for fire insurance premiums, and L.1423 rent for hire of additional waggons under special agreement, including therein the purchase-money, such rent being terminable in ten years, when the waggons become the property of the company, leaving a balance for the half-year of L.553,637. To this sum is added L.5487 brought from the preceding half-year's account, L.4264 balance of revenue account of Kennet and Avon Canal for the half-year, and L.8950 for dividends on shares in the South Devon and South Wales Railways; total, L.572,338. From this sum is deducted L.20,188 for guaranteed annuities on the Wilts, Somerset, and Weymouth Railway and Kennet and Avon Canal, L.21,114 rent charges on the Gloucester and Dean Forrest, Hereford, Ross, and Gloucester, Brentford and Wycombe Railways, and of Paddington Estate, L.13,511 loss on lease of South Wales Railway, L.2000 balance in full of the Kennet and Avon Canal loss to the 30th of June, 1856, L.241,193 for nett interest on loans, L.1,331 interest on Berks and Hants Extension shares, L.109,416 interest on Great Western preference stocks, and L.6279 for deficiency of revenue on Shrewsbury lines, making together L.415,183, and leaving a disposable balance of L.157,154. Out of this sum the directors recommend a dividend at the rate of 3½ per cent. per annum on L.8,237,276, being for the half-year L.143,152, leaving a balance of L.14,002 for the next half-year's account. Some disappointment has been felt at the Great Western dividend not being at a higher rate than 3½ per cent. per annum, as it was fully expected in the early part of the past half-year that it would not be less than at the rate of 4 per cent. Owing, however, to the prevalence of bad weather during the half-year, there was a falling-off in the receipts for passengers of L.16,850 as compared with the corresponding period of 1859, instead of a progressive increase, as in preceding years. There was also attributable to the unfavourable weather an additional expenditure in the maintenance of way and works of about L.5500. The total receipts for traffic during the half-year showed an increase of L.11,724 over those for the corresponding half of 1859, arising from an increase of L.29,230 in the goods traffic; but there was also an increase in the expenditure of L.15,029, of which L.5500 was absorbed in the maintenance of way, and the remainder in the carrying and other departments. Had the passenger traffic been only the same as at the corresponding period of 1859, a dividend at the rate of 4 per cent. could have been declared, leaving a balance of about L.9000 over for the next account. As it is, the dividend for the year 1860 on the Great Western ordinary stock will amount to L.3 5s. per cent., against L.2 15s. per cent. for the year 1859, showing an increase of 10s., which appears to be quite as much increase as can be expected under the circumstances.

Thames Tunnel.—The annual report stated that the total receipts were L.5755. The expenditure for machinery, salaries, &c., was L.3432; and, after payment of L.1578 to the commissioners of loans, there remained a balance of L.744.

Eastern Counties.—It appears that the directors of this company, at their last meeting, determined to adopt a system of communication between the guard and engine-driver of a train, which will in the first instance be applied to express and fast trains, with a view, however, to its extension to ordinary trains.

Pressure of the Wind.—During the terrific gale which occurred on the 21st ult., the anemometer at Lloyd's marked 36 pounds pressure on the square foot. As this is the heaviest gale recorded here for very many years, it will be interesting to see the above result compared with the notes of observers at different stations.

Excisable Articles.—In 1859 the quantity of hops retained for home consumption was 67,143,652lb.; in 1860 only 10,352,520lb.—not a sixth of the previous year's crop. The quantity of malt also fell off from 47,746,289 bushels in 1859 to 41,754,050 bushels in 1860. British spirits from 23,878,688 gallons in 1859 to 21,404,088 in 1860. The quantity of paper increased from 197,684,847lb. in 1859 to 207,182,013lb. in 1860.

Traffic Through France.—There is a great increase observable this year in the traffic passing from the north to the south of France. On the Paris, Lyons, and Mediterranean line the increase in the last weekly return was no less than L.19,291, and on the Northern L.7446; while, since the commencement of the year, the collective increase on the two lines (not including the new *réseaux*, which have remained stationary), has been L.91,563.

The Railway Host.—In the middle of last year the railways in operation in the United Kingdom had 127,450 persons in their employment, and the railways in course of construction employed 53,923 more, making in all 181,373. On the railroads in operation there were 3601 stations. There were 1051 miles of railroad in course of construction, and upon them were employed 7381 artificers and 42,126 "labourers;" but the word "navvy" does not seem to be admissible in these returns made to the Board of Trade.

Metropolitan.—Since the discontinuance of the severe weather the works on the Paddington, Marylebone, King's Cross, and Victoria Street sections have been carried on vigorously, both in respect to the tunnel works and the sites for the terminal and intermediate stations, of which latter there will be six—namely, in the Edgeware Road, Baker Street, Portland Road, Gower Street, King's Cross, and Victoria Street, Smithfield. It is in contemplation to extend the line, should powers be granted this session, to join the eastern lines at the proposed great station at Finsbury Circus, and so uniting them with the western and north-western railways.

Public Income.—For the year 1860 the public income of the United Kingdom amounted to L.71,967,494, of which sum the customs and excise duties supplied L.42,101,394, and stamps and taxes, L.24,313,074, the property-tax alone bringing in no less than L.12,901,816. The expenditure of the year amounted to L.72,578,632. The interest of the national debt took L.26,833,470, the military expenditure L.30,462,242, the civil expenditure, L.10,489,518, the collection of the revenue, L.4,509,402. The total is completed by a payment of L.284,000 for drawback on wine in stock when the act of last session was passed.

Grand Trunk of Canada.—The traffic receipts on this line for the week ending the 19th of January amounted, for local passengers, to 10,756 dols., for foreign passengers, 2338 dols.; for mails, express, &c., to 2728 dols.; for local freight and live stock to 31,814 dols.; for timber and lumber to 384 dols.; for firewood to 915 dols.; and for foreign freight and live stock to 6614 dols.; total, 55,549 dols., against 50,098 dols. for the corresponding week of last year, showing an increase of 5451 dols., although the traffic was interrupted by heavy snow-storms. The total traffic receipts from the 1st of July, 1860, to the 19th of January last amounted to 1,961,193 dols., and for the corresponding period of the preceding year to 1,514,228 dols., showing an increase of 446,965 dols., or about 29½ per cent.

Locomotives on Common Roads.—In anticipation of the adoption and use of locomotives on turnpike and common roads, for which the general turnpike and highway and local acts make no provision, the bill intended to regulate the use of them provides for the levying of tolls by uniform general provisions, the weighing clauses in the general turnpike acts not having been framed in anticipation of traffic by locomotives. Certain enactments of the Commercial Roads Continuation Acts are repealed, and the weight on each pair of wheels is not to exceed one ton and a half. The use of locomotives destructive to highways or dangerous to the public, is to be prohibited by the Secretary of State, so as to prevent excessive wear and tear. The weight of locomotives over county, parish, or suspension bridges is not to exceed 15 tons, and any damage is to be made good. The locomotives are to consume their own smoke. Two persons are to drive and conduct every locomotive, and red lights are to be fixed conspicuously in front of locomotive and waggons one hour after sunset and one hour before sunrise. The speed of locomotives on high roads is not to exceed 10 miles an hour, and through towns, cities, or villages, five. No locomotive is to be used within the city of London more than 7 feet in width, and with wheels 6 inches wide.

French Railway Traffic.—A return, issued by the Minister of Public Works, shows that the receipts on the old lines amounted in 1860 to L.14,220,846 on 4259 miles, against L.13,681,739 on 4221 miles in 1859, showing an increase of L.539,107. The total receipts on the new lines were last year L.2,107,703 on 1430 miles, against L.1,863,455 on 1267 miles in 1859, showing an increase of L.243,281. The aggregate receipts of the new and old lines for 1860 were L.16,328,549 on 5689 miles, against L.15,545,194 on 5488 miles in 1859, showing an increase of L.783,355, or 5 per cent.

British and Irish Magnetic Telegraph.—The report of the directors stated that the gross income of the year 1860 amounted to nearly L.90,000 against L.74,000 in 1859, L.73,000 in 1858, and L.71,200 in 1857, the year when the two companies were amalgamated. This large increase was not derived from any one particular source, but partly from the extensions of 1859, and from a general growing use of the telegraph by the public. The net increase, compared with 1859, amounted to L.6600, and after paying the 7 per cent. preference dividend, the interest on the debentures, and a dividend at the rate of 5 per cent. per annum for the last half-year on the ordinary stock, there remained L.2000. The balance-sheet showed that L.756,623 had been expended on capital account.

Railway Traffic.—The traffic returns of railways in the United Kingdom for the week ending the 16th of February amounted to L.467,474, and for the corresponding week of last year to L.443,461, showing an increase of L.24,013. The gross receipts of the eight railways having their termini in the metropolis amounted to L.199,550, and for the corresponding week of 1860 to L.191,935, showing an increase of L.7615. The increase on the Eastern Counties Railway amounted to L.672; on the Great Northern to L.580; on the Great Western to L.1578; on the London and North-Western to L.1540; on the London and Blackwall to L.46; on the London, Brighton, and South Coast to L.1213; on the London and South-Western to L.1521; and on the South-Eastern to L.465; total, 7615. The receipts on the other lines in the United Kingdom amounted to L.267,924, and for the corresponding week of last year to L.251,526, showing an increase of L.16,398, which, added to the increase on the metropolitan lines, makes the total increase L.24,013, as compared with the corresponding week of 1860.

New Cannon.—The *Moniteur de l'Armée* announces a new kind of warlike weapon, which it designates as an extraordinary production, and one which, from its originality, is expected to surpass all others. This cannon is of open work throughout its entire length, a mortar forming its breech. To load, the mortar is separated from the cannon by sliding on a thick iron shaft adhering to the cannon. Whenever it is detached for the purpose of loading it becomes a mortar, and can then be used either to throw a shell or to be again attached to the cannon. The cannon, being of open work, cannot be heated, and there is nothing to check the rapidity of firing. But what is said to be one of its most important qualities is its facility of transport, as cannon of the largest calibre can be taken to pieces. The War-office has appointed a commission, composed of artillery and engineer officers, to examine the gun and make a report on it.

Income-Tax.—A return has been issued which shows what progress this kingdom has been making within the last few years. The total amount of income and annual value of property assessed to the Income-tax in the United Kingdom has risen from £308,317,656 in 1854 to £335,730,254 in 1860. The increase of taxable income in England in the six years has been £26,348,685, and in Ireland £1,701,993, but in Scotland there has actually been a decrease of £638,080. This decrease has arisen solely from a very large falling off in the returns under schedule D—the profits of trades and professions, &c. The income taxed under that schedule in England rose from £76,215,936 in 1854 to £81,921,267 in 1860, and in Ireland from £4,621,069 to £4,891,652, but in Scotland it fell from £12,185,924 in 1854 to £8,626,144 in 1860; in 1858, after the commercial crisis at the end of 1857, it fell £2,500,000 below the previous year, and has never recovered. The income assessed under schedule A, the annual value of lands, houses, &c., has risen greatly in all three kingdoms; in England it was £99,274,309 in 1854 and £112,082,749 in 1860; in Scotland, £11,947,791 in the former year, and £13,974,080 in the latter; in Ireland, £11,767,810 and £12,893,829 respectively; an increase of almost £16,000,000 in the whole, nearly half of which is from houses, and another quarter from an increase in the profit of railways. A very large increase has taken place also in Schedule E (public offices, pensions, and stipends), from £14,445,552 in 1854 to £19,636,220 in 1860. The total income assessed to the Income-tax in 1860 was, in England, £282,718,049; in Scotland, £29,913,124; in Ireland, £23,099,081.

Railway Passengers' Assurance.—The half-yearly report stated that the amount of premiums received and due for the half year ending the 31st of December last amounted to L.18,908 against L.15,588 in the corresponding half of 1859. The total income for the year 1860 was L.38,709 against L.30,766 during the year 1859, showing an increase of 25 per cent. The commission and Government duty amounted to L.2713, and the working expenses to L.4171; the amount paid for compensation being L.9971. After payment of interest to the proprietors, and the usual charge for liquidating preliminary expenses, a balance of L.9329 remained, to which must be added L.1624, making the total available balance L.10,954. From this sum interest at the rate of 4 per cent. per annum would be paid to the proprietors, and the remainder held as a fund to meet the risks upon the policies in force. The compensation paid during the year 1860 amounted to L.21,056, or 54 per cent. of the premiums received. This sum had been paid for 12 fatal cases and 1187 cases of personal injury. The number of casualties during the recent frost was quite unprecedented in the company's experience. Six claims for serious injuries arose from the accident at Wimbledon, in which the late Dr Baly lost his life. In a previous accident on the London and North-Western Railway, a gentleman named Kelly was killed. He was, however, insured in this office, and thus secured for his bereaved wife and large family the sum of L.1000, which they would have the consolation of soon receiving, and for which only 6d had been paid. It appeared that, in the general accident department, as many as 1 in 12 receive compensation for accidents.

Front-Ignition Cartridge.—Mr W. Sear has recently introduced an improved cartridge for breech-loading fire-arms. In the accompanying engravings, fig. 1 represents the chief part of the improved cartridge, made of metal, and accurately turned in a lathe to the diameter of the bore of the gun. This "metal end," as it is termed, has the fulminating powder within itself, the igniting wire being shown, fig. 3, projecting upwards. An enlarged collar formed on one end of this "metal end" or cap, serves as a false breech, for preventing the escape of the gas. Fig. 2 represents in section that part of the cartridge which conducts the spark to the front end of the charge of powder contained in the paper cases or tubes, shown in the engraving, fig. 3. In every paper case or tube, as represented in section by fig. 3, the conducting tube or ignition cone is surrounded by the charge of powder, and ready to be attached to, or removed from, the "metal end" *ad libitum*. In this sectional engraving of the cartridge the "metal end" is shown attached to the case of the cartridge, and ready for use. By inserting this complete cartridge at the breech of the gun the collar formed upon the one end of the "metal end piece" is held firm in its place by closing the "breech;" and during the discharge of the gun serves as a perfect joint between the breech and the barrel. This "metal end" can be re-capped and affixed to a new tube or case with much greater facility than the re-capping only of the French and other cartridges; and in the event of the case bursting in the barrel, the nicety of the fitting of the "metal end" prevents all loss of power. Another form of arranging an igniting tube is shown in the engravings, figs. 4 and 5. In this instance the igniting tube and "metal end" is formed in one piece with a nut only, within the case or tube of the cartridge; but in every other respect is similar to the modification already described, fig. 4 being an elevation of the "metal end" in this form of cartridge, and shown in the engraving detached. The shooting of all breech-loaders is improved by mixing with the shot about 1 dr. of ground rice, bone-dust, or ground chalk. It keeps all the gas behind the shots, prevents them forming into angles, and preserves their spherical shape, which shape meets with less atmospheric resistance; thus causing the shot to make a more even pattern or cluster, with still greater strength. A moderately thick elastic felt wadding, a gauge larger than the gun bore, is preferable to a thicker one. In the use of wire cartridges it is advisable to load with those which are numbered two sizes larger than the bore of the gun, tearing off the top wad, and substituting one of your own, previously to ramming down. It will then be found to fit and prevent the bulging of the barrel, which now frequently happens by the use of a cartridge numbered 12 or 14 in a gun of the same bore; they being, in fact, when the wad is torn off, two sizes less than the figures represent, and too small to fill the barrel—the consequence often being, that on the ignition of the powder, the cartridge suddenly, and with great stress, fills the barrel, which, if not very stout, gives way or bulges. No wire cartridge used in the manner recommended, will injure any gun if care be taken to ram it well home. In using these cartridges we have only to take off the nut, and push it down the case (as you would a wad), which it will fit rather tightly. Screw it on the cone with the hand, and apply the key, and tighten up; and, on refilling a case which has been used, previously apply the key to the cone.

Fig. 1.

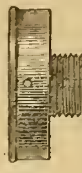


Fig. 2.

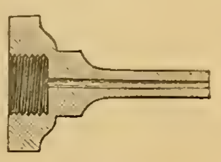


Fig. 3.

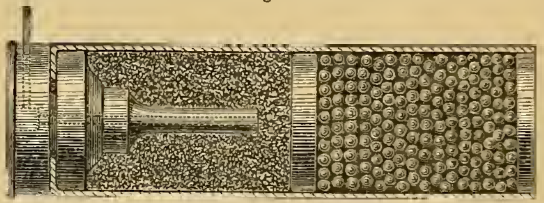


Fig. 4.

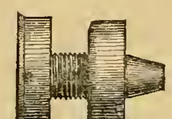
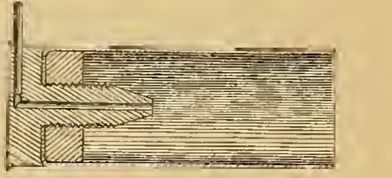


Fig. 5.



London District Telegraph.—This company appears to be progressing satisfactorily. The report states that, in consequence of the wet season, followed by the very severe frost, unexpected delays had occurred in carrying on the works. 52 stations were now open for messages, being an increase of 14 since the last report, and 21 more would be ready for opening very shortly. The greater portion of these new stations were being worked with only a slight addition to the previous staff; and there were sufficient clerks, either qualified or in training, to open the 21 stations with a trifling increase for wages, &c. Upon comparing the receipts for the two past half-years, there was an increase of L.508. The directors consider this to be a satisfactory proof that the public were beginning to appreciate the undertaking, even in its present incomplete state. The experience of the past year had shown that some re-arrangement of the tariff was desirable. The original charge was 4d for a message of ten words, but it was found that this scale did not allow a sufficient number of words, and there was a consequent increased charge for the message. It was, therefore, thought advisable to increase the number of words to 15, at a *minimum* charge of 6d. A scale for porterage beyond the limit of free deliveries had also been adopted, but this would gradually be avoided as additional stations were opened, except for very remote districts, and the directors believed that the public do not think these alterations unreasonable. In addition to the works now in progress, the directors had completed arrangements for the erection and working of several private telegraphs, on remunerative terms to the company. A considerable amount was due for calls. The working arrangements with the various other telegraph companies, whereby an interchange of provincial and continental messages was secured, to the advantage of the company and the general convenience of the public, continued most satisfactory.

RAILWAY TRAFFIC.—From a Board of Trade return just issued it appears that the total receipts on all the railways in the United Kingdom for the half-year ending 31st December, 1859, amounted to L.13,880,763 on 10,002 miles of railway against L.12,825,826 on L.9,542 miles of railway in the corresponding half of 1858, showing an increase of L.1,054,937 in the receipts, and 460 miles in the mileage. The total receipts from all sources in England and Wales, on 7309 miles of railway, amounted to L.11,733,966 against L.10,837,466 on 7000 miles at the corresponding period of 1858, showing an increase of L.896,500. The total receipts in Scotland on 1428 miles of railway amounted to L.1,455,720 against L.1,358,707 on 1353 miles in the corresponding half of 1858, showing an increase of L.97,013. The total receipts on 1265 miles of railway in Ireland for the above half year amounted to L.691,077 against L.629,653 on 1188 miles in the corresponding half of the preceding year, showing an increase of L.61,424. The total receipts from general merchandise, minerals, and live stock in the United Kingdom included above amounted to L.6,898,950 against L.6,333,334 in the same half of 1858, showing an increase of L.565,616. The total number of passengers conveyed during the half-year in question was 82,527,594 against 76,529,204 in the corresponding half of the preceding year, showing an increase of 5,998,390 passengers. The number of parliamentary passengers conveyed was 34,381,321 against 30,790,352, showing an increase of 3,590,969. The number of third-class passengers conveyed was 13,498,346 against 13,370,758, showing an increase of only 127,588. The number of second-class passengers conveyed was 24,357,188 against 22,536,911, showing an increase of 1,820,277. The number of first-class passengers conveyed was 10,290,739 against 9,831,181, showing an increase of 459,558. The receipts from parliamentary passengers amounted to L.1,704,196 against L.1,521,740, showing an increase of L.182,456; from third-class passengers to L.533,169 against L.519,133, showing an increase of L.14,036; from second-class passengers, L.2,103,715 against L.1,958,092, showing an increase of L.145,623; and from first-class passengers to L.1,740,044 against L.1,668,080, showing an increase of L.71,964.

COINAGE OF THE UNITED STATES.—The value of the money coined in the United States last year was:—Gold, 23,447,283 dols.; silver, 3,250,636 dols.; copper, 342,000 dols.; making a total of 27,039,919 dols. This amount was made up as follows:—Gold, 772,994 double eagles of the value of 15,458,900 dols.; 34,213 eagles of the value of 352,130 dols.; 72,213 half-eagles of the value of 361,145 dols.; 20,402 three-dollars of the value of 61,206 dols.; 51,592 quarter-eagles of the value of 128,980 dols.; 93,215 dollars of the same numerical value, and five bars of the value of 7,001,807 dols. Silver, 600,530 dollars of the same numerical value; 3,254,800 half-dollars of the value of 1,627,400 dols.; 1,321,800 quarter-dollars of the value of 330,450 dols.; 986,000 dimes of the value of 98,600 dols.; 1,930,000 half-dimes of the value of 96,500 dols.; 548,000 three-cent pieces of the value of 16,440 dols., and bars of the value of 480,716 dols. Copper, 34,200,000 cents of the value of 342,000 dols. Of the total money coined Philadelphia turned out 5,553,633 dols.; New Orleans, 1,767,422 dols.; San Francisco, 12,461,911 dols.; Dahlonega Ga, 69,477 dols.; Charlotte, N.C., 133,697 dols.; New York Assay-office, 7,053,758 dols. The total of 27,039,919 dols. is below the average of the last few years. The coinage since 1792 has been as follows:—Philadelphia, 423,425,504 dols.; New Orleans, 69,201,833 dols.; San Francisco, 118,029,225 dols.; Dahlonega, 6,060,973 dols.; Charlotte, N.C., 4,978,061 dols.; New York Assay-office, 94,532,996 dols.; making a total of 716,229,594 dols.

LONDON FIRES.—With reference to the 1056 fires which occurred in London last year, Mr Baddeley, C.E., who has devoted great attention to the subject, classifies the causes as follows:—Unforeseen, and, for the most part, unavoidable accidents, 4; apparel ignited on the person (in each case attended with fatal results), 5; lights thrown down areas, 6; accidents with candles, 121; ignited bed-curtains, 74; ditto, window curtains, 25; carelessness, 7; roasting of chicory, 1; children playing with fire and candles, 12; ditto with gunpowder, 1; ditto with lucifer matches, 6; unextinguished cinders, 11; hot coke, 2; burning of cork, 2; improperly set coppers 2; copper flues, 9; fire sparks, 79; sparks from locomotives, 3; defective fireplaces, 3; letting off fireworks, 2; blocked-up flues, 10; defective and overheated ditto, 38; foul and ignited ditto, 21; hot air ditto, 3; friction, 1; frying fish, 1; incautious fumigation, 1; furnaces, 17; carelessness in lighting gas, 13; escaped gas from defective fittings, 39; ditto from street mains, 1; gas burning too high, or in contact with inflammable goods, 41; carelessness of gasfitters, 4; defective hearths, 3; fires made on hearths, 5; hot plates and flues, 5; intoxication (in four cases attended with fatal results), 19; overheated kilns, 5; oil lamps, 6; naphtha lamps, 2; melting of lead, 1; lighted paper thrown about, 7; slaking of lime, 4; linen drying or airing before fires (in one instance upset by a cat), 45; accidental ignition of lucifer matches, 3; lucifer match making, 3; incautious use of lucifer matches, 9; boiling of oil 3; defective and overheated ovens, 3; heating of pitch and tar, 9; upsetting of paraffin oil, 1; reading in bed, 1; ignition of loose shavings, 37; smoking bacon 1 drawing off spirits, 2; spontaneous ignition of asphalt sheathing, 1; ditto of coloured fire, 1; ditto of hay, 3; ditto of wet hemp, 1; ditto of lampblack, 5; ditto of manure, 1; ditto of wet matting, 2; ditto of oily sawdust, 5; ditto of oily rags, 5; ditto of wet rags, 7; heat from steam boilers, 5; heat from steam pipes, 2; defective and overheated stoves, 21; drying stoves, 10; gas stoves, 2; ironing stoves, 4; pipe stoves, 9; portable stoves, 3; tinman's stoves, 2; sugar boiling, 1; melting of wax and tallow, 2; throwing down unextinguished tobacco (fatal in two instances), 53; heating of turpentine, varnish, and inflammable compositions, 6; suspicions, 21; wilful (fatal in three instances), 54; and unknown (also fatal in three instances), 86.

ECONOMICAL BLUE DYEING PROCESS, BY MONSIEUR HOUGOUNENG.—It is the custom, after wool has been dyed blue with indigo, to wash it in running water, whereby a mixture of pure indigo, or of indigo combined with soda, potash, or lime, which the wool contains mechanically, is carried off. This surplus and uncombined colouring matter is entirely lost. The principal object of Monsieur Hougouneng's system is to collect and utilize these dye products, which he does in the following manner:—The wool, on being removed from the dye-vat, is placed in a bucking-tub filled with water, and communicating with another bucking-tub by means of a moveable wooden trough, each end of which rests on the edge of each tub, but so as to form an inclined plane. The wool, after having been dyed, is immersed in one of these tubs, and a portion is taken out and well kneaded in the trough, which, being on an incline, allows the dye-water extracted from the wool to run into, and to be collected in, one of the tubs. When the whole of the wool has undergone this operation, it is placed in a basket under a running stream of water which flows in the other tub. To remove all the colouring matter which may adhere to the wool, it should be pulled apart, and the water be allowed to run through until this becomes almost colourless. When the water in the first tub appears sufficiently charged with colouring matter, it is poured into a reservoir set apart for this purpose, and the water in the first tub mixed up with it. By this process a given quantity only of water is used. Care must be taken not to pour the water into the reservoir without first straining it through a sieve, in order to keep back all impurities it may contain, such as branches, straws, waste wool, &c. When the reservoir is filled, a sufficient quantity of hydrochloric acid is added to its contents, which produces an effervescence, owing to the reaction which takes place. The acid decomposes the carbonates and sulphates, disengaging carbonic acid and sulphuretted hydrogen; at the same time the indigotates of lime, soda, or potash are decomposed, and the indigotine is liberated, which subsequently settles, carrying with it the uncombined indigo contained in the washings. The quantity of hydrochloric acid to be used will vary, according to the strength of the liquors operated upon; but in every case a quantity of acid should be added, so as to communicate a slight acid reaction to test paper after admixture.

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded October 15, 1860.

2514. Peter R. Smith, Essex Street, Strand—Improvements in fire arms and ordnance, and in the projectiles to be issued therewith.

Recorded October 25.

2598. Anton Verwey, Croydon Grove, Croydon, Surrey—Improvements in the manufacture of soap.

Recorded November 6.

2724. Cæsar Neumann, New York, New York, U.S.—Certain improvements in the manufacture of hoop skirts, and in the machinery employed therein.

Recorded November 19.

2838. George Chowen, Dippertown, Devonshire—Improvements in obtaining motive power by hydraulic means.

Recorded December 11.

3037. Joseph Hamerton, Shibden, near Halifax, Yorkshire—Improvements in manufacturing certain textile fabrics, known as "zebra cloth" or triple cloth.

Recorded December 12.

3051. George S. Harwood, Bradford, Yorkshire—Improved machinery for drying, stretching and tentering woollen or other cloths.—(Communication from Charles F. Bennett, Connecticut, U.S.)

Recorded December 17.

3096. Edward Barlow, Bolton-le-Moors, James Newhouse, Farnworth, and Francis Hamilton, Bolton-le-Moors, Lancashire—Certain improvements in machinery for carding cotton and other fibrous substances.

3093. John W. Hill, Philadelphia Place, Hackney Road—Improvements in sewing machines, and the use thereof.

Recorded December 22.

3151. Alfred Savage, Eastcheap—Improved apparatus for separating, reducing in size, and mixing articles of grocery.

Recorded December 29.

3185. John Brinton and John Lewis, Kidderminster, Worcester—Improvements in the manufacture of pile carpets, rugs, and other pile fabrics.

Recorded January 4.

20. Thomas Cobley, Meerholz, Hesse, Germany—Improvements in the mode of obtaining or manufacturing commercial salts of lead directly from the ores of lead.

Recorded January 5.

36. William M. Williams, Handsworth, Staffordshire—An improvement or improvements in treating coal and other bituminous minerals and peat, for the purpose of obtaining solid and liquid hydro-carbons therefrom.

Recorded January 9.

58. Claude N. Leroy, Paris (Passy)—An improved grease for lubricating the frictional surfaces of machinery.

Recorded January 11.

76. Paul Laffitte, jun., Gironde, France—An improved instrument for writing and printing music.

Recorded January 15.

108. Samuel Hemming, Moorgate Street—Improved rifle ranges, and butts and appliances connected therewith.
114. Charles Stevens, Charing Cross—A new paste made from wood to be used in the manufacture of various articles, together with the apparatus employed in the preparation of the same.—(Communication from Mr Loyer, Rue Laffitte, Paris.)
116. Antoine G. Lasserre, Bordeaux, Gironde, France—Improvements in the manufacture of fuel, and in apparatus connected therewith.

Recorded January 19.

154. Donald Mana, Rochester, New York, U.S.—Improvements in rotatory spading and digging machines.

Recorded January 21.

165. Thomas Stewart, Northampton Street, Clerkenwell—Improvements in vehicles known as Hansom cabs.

Recorded January 22.

167. Charles W. Siemens, and Frederick Siemens, Great George Street, Westminster—Improvements in furnaces.
168. Christopher Duckworth, Pendleton, Lancashire—An improved mode of manufacturing fabrics for useful and ornamental purposes.
169. George White, Pancras Lane—An improved warping and beaming mill.—(Communication from Casper Honegger, Ruti, Switzerland.)
170. William Cooke, Charing Cross—Improvements in apparatus for filtering.
171. Richard Phillp, and John Philip, Lower John Street, Golden Square—An improvement in propellers for propelling ships, boats, and other vessels in water.
172. Edward Ellis, Bangor, Carnarvon—Improved machinery or apparatus for picking or cleaning "oakum," and for spinning or twisting the same for the purpose of calking ships or vessels
173. Robert Henderson, Park Place, Bayswater Road—An improved "dumb jockey," for breaking or training horses.
174. Henry R. Cottam, Middlesex—Improvements in folding chairs, cots, and such like articles to sit and recline on.
175. John Chatterton, Highbury Terrace, and Willoughby Smith, Pownall Road, Dalston—Improvements in the manufacture of telegraphic cables.
176. Arthur E. Holmes, Derby—Improvements in carriage springs.
177. Richard A. Brooman, Fleet Street—An improved method of manufacturing tyres for wheels, hoops, and rings.—(Communication from Société des forge, Montsataire, France)

Recorded January 23.

178. David Smithies, Rochdale Road, and John Jackson, Holyrood Terrace, Manchester—Improvements in the manufacture of healds or harness for weaving.
179. William Westley, Northampton—Improvements in the manufacture of boots and shoes.
180. William Brown, Wigan, Lancashire—An improved stripper for carding machines.
181. William Clark, Chancery Lane—Improvements in thrashing machines.—(Communication from Charles E. Lambert, jun., Boulevart St. Martin, Paris)
182. William Clark, Chancery Lane—Improvements in circular looms for weaving hats and other articles.—(Communication from Louis Bonard, New York, U.S.)
183. William Clark, Chancery Lane—Improvements in ships' sails.—(Communication from Justin L. H. E. Bonnet, Boulevart St Martin, Paris)
184. James Deakin, and John Cresswell, Birmingham, Warwickshire—Certain improvements in shutters.
185. William Wilson, Newcastle-upon-Tyne—Improvements in the manufacture of hats.
186. Alexander Prince, Trafalgar Square, Charing Cross—An improved induction and eduction valve for steam engines.—(Communication from Thomas Goodrum, Providence, Rhode Island, U S.)
187. Richard A. Brooman, Fleet Street—Improvements in sewing machines, particularly applicable to the stitching or sewing of gloves, and other articles where circular or partially circular parts are to be connected together.—(Communication from Edouard P. Lecerf, Paris.)

Recorded January 24.

188. Thomas Haworth, Nut Mill, Bacup, Lancashire—Improvements in machinery or apparatus for governing or regulating the speed of steam engines or other motive power.
189. Henry Henderson, Edinburgh—Improvements in machinery or apparatus for printing yarns or threads, part of which machinery or apparatus is applicable to the twisting of fibrous materials.
190 Frederick G. Mulholland, Great Orford Street, Marlborough Road, Chelsea—Certain improved apparatus for preventing steam boiler explosions, and for decolorizing the gaseous products of furnace fuel in a state of combustion.
191. Rebecca Thomas, Bath Street, Tabernacle Square—Improvements in the tires of wheels for vehicles used on common roads.
192. Henry D. O'Halloran, Kensington—An improved sporan or excursion bag especially suitable for volunteer riflemen and tourists.
193. George T. Selby, Smethwick, Staffordshire—Improvements in the construction of masts and posts.
194. Thomas Gibson, William Knighton, and Henry Knighton, Staveley Works, Derby—Improvements in core barrels for casting pipes, cylinders, retorts, and other like hollow articles.
195. Daniel J. Fleetwood, Birmingham, Warwickshire—Improvements in apparatus for rolling metal.
196 William Longmaid, Inver, Galway—Improvements in the manufacture of iron and steel.
197. Nathaniel W. Doberson and George Warren, Gateshead—Improvements in the manufacture of glass.
198. James Vero, Atherstone, Warwickshire—Improvements in machinery for separating the fur or hair from the skins of animals.

Recorded January 25.

199. Edward T. Hughes, Chancery Lane—Improvements in machinery or apparatus for pulverising clay and other materials.—(Communication from Messrs. Léon and Edouard P. D. Lafrage, Viviers, France.)
200. Gaylard Hadwen, Audenshaw, Lancashire—Improvements in the double lift jacquard machine, as applicable to power looms.
201. Richard A. Brooman, Fleet Street—Improvements in reaping and mowing machines.—(Communication from Jean L. Dewaroquier, Paris)
202. Samuel Needham, Oriel Place, Chelsea—Improved spring apparatus applicable to bedsteads and other articles to which springs may be applied.
203. Jesse Law, Hollinwood, Lancashire—Improvements in shutting off the steam and operating upon the breaks of engines employed in lowering into and lifting from mines or pits.
204. Bernard Lauth, Pittsburgh, Pennsylvania, U.S.—Improvements in piling iron for heating, preparatory to re-rolling or hammering the same.
205. Alfred F. Yarrow, and James B Hilditch, Arundel, Banbury—Improvements in means or apparatus used in ploughing, tilling, or cultivating land.
206. Charles Lungley, Deptford Green, Dockyard, Kent—Improvement in the construction of ships and other vessels for war purposes.

Recorded January 26.

207. James Durraat, Fitzroy Square, and Noel Alleyne, Bayswater—Improvements in the form and construction of chimney tops or appliances for surmounting chimneys, in order to regulate the up currents, and obviate the down draughts.
208. Charles Bishop, St. Helen's, Lancashire—Improvements in the ornamenting of glass.
209. Charles A. Drevet, South Street, Finsbury—Improvements in the manufacture of sulphurous acid, sulphites, bi-sulphites, and sulphuric acid, and in the apparatus employed therein, and in the application of one of the products of such manufacture to the bleaching of textile, animal, and vegetable substances.
210. Thomas Bradford, Manchester, Lancashire—Improvements in machines for washing, rinsing, and blueing clothes, fabrics, yarns, and similar articles.
211. Frederick W. Webster, Whitstable, Kent—Improved apparatus applicable for washing, and churning.
212. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in obtaining motive power from the expansion and compression of air, gas, or vapour, and in the machinery or apparatus employed therein.—(A communication from Auguste Prouvost, Paris.)
213. Robert Mushat, Coleford, Gloucester—An improvement or improvements in the manufacture of melting pots or crucibles.
214. John Arrowsmith, Bilston, Staffordshire—Improvements in the manufacture of armour plates for gunboats and land batteries, and in machinery and furnaces used in the said manufacture.
215. George Hallett, Broadwall, Lambeth, Surrey, and John Stenhouse, Rodney Street, Pentonville—Improvements for the manufacture of pigments for coating surfaces.
216. Henry Bessemer, Queen Street Place, New Cannon Street—Improvements in ordnance and projectiles.

Recorded January 28.

217. James Clark, Harleyford Place, Kensington, Lambeth, Surrey—The application of a paste of whatever wood, to any kind of ornamental and other mouldings, without the least admixture of any other materials, or use of any chemical agent.—(Communication from Aloise E. Miller, Neumühle-Luxembourg, Holland)
218. John Boulby, Whitby, Yorkshire—An improved log or instrument for measuring the speed of ships and the velocity of streams of water.
219. Charles de Bergue, Dowgate Hill—Improvements in machinery for shaping metal.
220. James Badcock, Canhall Gate, Wanstead, Essex—Improvements in signalling between the different carriages of railway trains and other engines.
221. Herbert W. Hart, Rue Bergère, Paris—Improvements in gas burners.
222. Frederick H. Twilley and Albert Romer, Dean Street—Improvements in tobacco-pouches, purses, and other such like receptacles.
223. Gustave A. Rothholz, and Morris Rosenthall, Goulston Street, Whitechapel—An improved combined garment for gentlemen s wear.
224. William E. Newton, Office for Patents, Chancery Lane—Improved apparatus for exhausting and compressing air, and producing air blasts.—(Communication from Frederick W. Partz, New York, U.S.)
225. William E. Newton, Chancery Lane—An Improvement in dinner plates.—(Communication from William H. Towers and John H. Browning, New York, U.S)
226. William E. Newton, Office for Patents, Chancery Lane—Improvements in railway carriage wheels.—(Communication from Ebenezer A. Lester, Boston, Massachusetts, U.S.)
227. John G. Mason, Ironmonger Street, Stamford, Lincoln—Improvements in chimney tops.
228. James A. Shipton, Wolverhampton, Staffordshire—Improvements in steam engines.

Recorded January 29.

229. Theodor A. Verkruzen and Moritz A. Verkruzen, Hatton Garden—A metal paint, and for applying the same by painting in gold, and imitation gold, silver, or other metal colour on velvet, cloth, and other fabrics having a pile or woolly, flossy surface.
230. William Winstanley, Joseph Kelly, William Payne, and John Formby, Liverpool, Lancashire—Improvements in pumps, and the apparatus for working the same.
231. Edward W. Furrell, Kensington—An improved means of communication between the guard and the engine-driver of a railway train.
233. William F. Fleming, Halifax, Yorkshire—An improvement in "bottle-cleaners."
234, John W. Friend, Freemantle, Southampton—Improvements in beer engines
235. John H. Ashford, Loxbeare, Tiverton, Devonshire—Improvements in signals for communicating between the passengers of railway-trains and the engine-driver and guards.
237. Robert Culverwell, Plymouth, Devonshire—Improved apparatus for obtaining motive power or communicating motion to machinery.
238. Enrico A. L Negretti and Joseph W. Zambra, Hatton Garden—Improvements in mountain and other barometers.
239. Charles E. Crawley, Gracechurch Street, E.C., and Theodore Schneider, Horseferry Road, Westminster—Improvements in safety and other lamps.

Recorded January 30.

240. Alexander Courtois and Jerome E. de Soulange, Paris—An improved construction of kiln for calcining limestone, gypsum, or other similar substances.
241. Alexander Courtois, and Jerome E. de Soulange, Paris—Improved construction of kiln for baking bricks, tiles, or other similar articles.

242. John Mellor, jun., Kings Bridge, Huddersfield, West Riding, Yorkshire—An improved machine called a "cross raising gig," used in the dressing of woollen cloth.
243. Samuel T Crook, Halifax, Yorkshire—Improvements in the construction of boilers employed for warming buildings.
244. Arthur Boyle, Birmingham, Warwickshire—Improvements in the manufacture of umbrellas and parasols.
245. William Archer, Bolton, Lancashire—Certain improvements in jacquard machines.
246. Ephraim Smith, Carlisle Street—An improvement in the manufacture of swivel-rings, especially applicable to swivels and watch keys.
247. John Poole, Bletchley, Bucks, and James Wright, Bridge Street, Blackfriars—Improvements in steering or guiding steam or other vessels, and also in working or actuating their rudders.
248. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in the manufacture of lasts for boots and shoes.—(Communication from John C. Plumer, M.D., Portland, U.S)
249. Henry Phillips, Pinhoe, Devonshire, and James Bannehr, Exeter—Improvements in urinals, and in the manufacture of manure when urine is used.
250. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in the manufacture of boots and shoes.—(Communication from John C. Plumer, M.D., Portland, U.S.)
251. George T. Bousfield Loughborough Park, Brixton, Surrey—Improvements in the manufacture of shoes for horses, and other hoofed animals.—(Communication from Rollen A. Goodenough, Brooklyn, U.S.)
252. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the treatment of vegetable substances, and in the preparation of beverages therefrom.—(Communication from Louis H. Obert and Jean B. Vasseur, Paris.)
253. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the construction and internal arrangement of railway carriages.—(Communication from Edward Burke and Thomas A. Andrews, Philadelphia, Pennsylvania, U S.)
254. Robert B. Longridge, Manchester, Lancashire—Improvements in promoting the circulation of water in steam boilers, and in supplying water to steam boilers.
255. William Clark, Chancery Lane—Improved spring hinges.—(Communication from Charles F. A. Aruaud, Paris.)

Recorded January 31.

256. Charles Reeves, Birmingham, Warwickshire—A new or improved instrument or apparatus for converting breech-loading small arms into muzzle loading small arms, and an improvement or improvements in cartridges for breech loading arms.
257. Robert D. Cleg, Fleet Street—Improvements in time-keepers, called "Atmospheric clocks, or mercurial time keepers."
258. James Robertson, Avon Bank, Lanarkshire—Improvements in machinery or apparatus for finishing textile fabrics.
259. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery or apparatus for roasting coffee and other seeds and roots, and for drying grain.—(Communication from Robert Harper, Melbourne, Victoria.)
260. Stephen Moulton, Bradford, Wiltshire—Improvements in the construction of cables for telegraphic purposes.
261. Sylvester W. Warren, Brooklyn, King's county, New York, U S.—An improved high and low water indicator for steam and other boilers
262. Isaac Rogers, Haverstraw, Rockland New York, U.S.—Improvements in furnaces for treating iron ores.
263. John Chatterton, Highbury—Improvements in treating gutta percha, India rubber, and compounds containing one or both of these substances, and in machinery and apparatus employed therein.

Recorded February 1.

264. Edward W. Furrell, Kensington—Improvements in the method of, and apparatus for, communicating between the guards, or the passengers and the engine drivers of railway trains.
265. Theodore Lemeille, High Holborn—Engines for the extraction of the produce of mines, and new arrangement of the ropes for suppressing all dead weight.
266 Robert Kuntsmann, Manchester, Lancashire—An improved apparatus for lubricating the frictional surfaces of machinery.
267. Henry Curtiss, Skinner Street, Snow Hill—Improvements in men's scarfs, cravats, and neck ties.
268. James M. Park, Glasgow, Lanarkshire—Improvements in sun blinds or shades.
269. Alexander Crichton, Cork—Improvements in applying and fitting screw propellers, and in forming and fitting the stern parts of ships for receiving screws.
270. Walter Hart, Norwich—Improvements in sewing machines.
271. Jose J. de Arrietta, Piccadilly—Certain applications of chapapote and its products, and of the same combined with other substances, and of materials treated therewith, to various purposes in manufactures and the useful arts.
272. Alfred V. Newton, Chancery Lane—An improved construction of motive power engine.—(Communication from W. H C. Voss, Berlin.)
273. Henry Medlock, Great Marlborough Street, Westminster—Improvements in brewing malt liquors.
274. Morris Pollok, the younger, Govan, Lanarkshire—Improvements in machinery or apparatus for winding yarn or thread
275. Henry Bressemer, Queen Street Place, New Cannon Street—Improvements in the manufacture of malleable iron and steel, and in the machinery or apparatus employed in such manufacture.
276. Thomas E. Knightley, Cannon Street—Improvements in constructing stable floors.

Recorded February 2.

277. George H. Spencer and Richard G. Cook, Hathersage, Derbyshire—Improvements in umbrella and parasol furniture, and in the means or apparatus employed in treating umbrella and parasol furniture, parts of which are also applicable in heating steel wire ribs, rods, or tubes for other purposes.
278. Edward T. Hughes, Chancery Lane—Improvements in the manufacture of woven fabrics, and in the machinery employed therein.—(Communication from Eugene Mouline, France.)
279. William Prangley, Salisbury—Improvements in pianofortes.
280. John Cameron, Hindpool, Lancashire—Improvements in purifying water for the supply of steam boilers and other uses.
281. Augustus L. Bricknell, Loughborough Park, Brixton, Surrey—Improvements in fire escapes.
282. William Clark, Chancery Lane—Improvements in the manufacture of paper pulp. (Communication from Louis Gaucher and Auguste Somme, Boulevart St Martin, Paris).
283. William Clark, Chancery Lane—Improvements in bellows—(Communication from Charles J. P. Desnos-Gardissal, Boulevart St Martin, Paris.)
285. William N Wilson, High Holborn, and William T. Rawlett, Leicester—Improvements in sewing machines and in apparatus connected therewith
286. James G. Marshall, Headingley, Leeds, Yorkshire—Improvements in the treatment of flax, hemp, and other fibres in various stages of preparation and manufacture.

Recorded February 4.

287. Jaste S Larue, Paris—A mode of greasing pistons and slide-valves, even in course of working, applicable to all sorts of machines having the same.
288. David Walmsley and John Rostron, Disley, Chester—Improvements in apparatus for providing against accidents in hoisting machinery, part of which improvements are applicable to railway carriage coupling links.
289. John Abraham, Birmingham, Warwickshire—An improvement or improvements in brass nails to be used in sheathing ships, and for other like purposes.
290. Auguste E. C. de Balyon, Paris, Faubourg Montmartre—Improvements in the manufacture of woven fabrics.
291. Robert Howarth, Mount Pleasant, Bury, New Road, Manchester—Improvements in machinery for raising pile on woollen, cotton, and other fabrics.
292. Edward C Morgan, Norwich—Improvements in carriage building.
293. Richard A. Brooman, Fleet Street—Improvements in carving or figuring wood.—(Communication from Emile C. A. Brehon, Paris)
294 John Murray, Whitehall Place—Improvements in railway carriages.

Recorded February 5.

295. George W. Belding, Moore Lane, Cripplegate—Improvements in skeleton petticoats.—(Communication from William S. Thomson, Broadway, New York, U.S.)
297. George Williams, Liverpool, Lancashire—Improvements in the construction of charcoal and other kilns.
299. Joseph T. Wood, Strand—An improvement in open work fabrics, suitable for ladies' collars, cuffs, and such like articles, and for purposes for which perforated paper and cardboard are employed.
300. Henry Dixon, Park End, Sydenham, Kent—Improvements in apparatus for signalling in railway trains.
301. John Leeming, North Holme Mill, Bradford, Yorkshire—Improvements in looms.
302. James Purdey, Oxford Street—Improved apparatus for ramming and turning over breech-loading cartridges.

Recorded February 6.

303. Edward T. Hughes, Chancery Lane—Improvements in shuttles for weaving.—(Communication from Philibert A. Trambouze, Thizy, Rhone, France.)
304. Adolphe Drevelle, Manchester, Lancashire—Improvements in machinery or apparatus for folding and measuring woven or textile fabrics, paper, and other materials, and for introducing cards into the folds ready for the press.
305. John Marsden, Orrell, Wigan, Lancashire—Improved machinery or apparatus for making, forging, and punching metal nuts, bolts, spikes, or washers.
307. Claude M. J. Bourcier, Paris, and Thomas Allan, Adelphi Terrace, Westminster—Treating certain animal sinews, in order to convert them into fibres or threads, preparing such threads or fibres to prevent decomposition, and the employment of the threads or fibres alone, or mixed with other fibres, for all purposes for which fibres are now used.
308. Charles W. Forbes, Southampton—An improvement in rests for rifles and other small arms.
309 William Clark, Chancery Lane—Improvements in preserving animal substances—(Communication from Camille G. M. Magneval, Boulevart St Martin, Paris.)
310. Andrew J. Robertson, Parliament Street, Westminster—Improvements in the construction of ships and vessels.

Recorded February 7.

311. John Beesley, Coventry, Warwick—Improvements in looms used in the manufacture of ribbons and other fabrics
312. John W. Wilson, Beevor Saw Mills, Barnsley, Yorkshire—Improvements in steam boilers, and in seatings for the same.
313. James E. Boyd, Hither Green, Lewisham, Kent—Improvements in the manufacture and preparation of paper, and in the method of printing, and otherwise preparing the same.

Recorded February 8.

314. Adolphe Drevelle, Manchester, Lancashire—Improvements in embroidering or ornamenting woven fabrics, felts, or other similar materials.
315. Thomas, Blezard and James Blezard, Padiham, Lancashire—Improvements in self-acting temples.
316. Michael J. Stark, Norwich—Improvements in the preparation of colouring matters for dyeing, staining, or printing fabrics, stuffs, and yarns of cotton, silk, or wool, or such like substances.
317. Thomas Banks and Thomas Morgan, Kidderminster, Worcester—An improvement or improvements in coating sheets or plates of iron with lead or tin, or alloys of lead and tin.
318. Benjamin Peake, Coventry, Warwick—An improvement in, or addition to, brocaded silk fabrics.
319. Robert Harrild and Horton Harrild, Farringdon Street—Improvements in apparatuses for printing addresses for newspapers and other similar purposes.
320. Robert M. M'Turk, Liverpool, Lancashire—An improved construction of neck-tie and attachment therefor.
321. William M. Storm, New York, U.S.—Improvements in the construction of ordnance and of projectiles to be used in ordnance.
322. John Branscombe, Noel Street, Islington—Improvements in telegraph cables.
323. William Morris, Kent Waterworks, Deptford, Kent—Improvements in valves.

Recorded February 9.

324. O'Donnell Grimshaw, Belfast—Improvements in locks.
325. Hermann Freystadt, Broad Street Buildings—Improvements in the manufacture of bodies for caps, hats, bonnets, baskets, bags, and reticules, and other similar articles of light work.
326. Charles J. Richardson, Kensington Square—Improvements in the armour of metal covering for iron-cased ships of war.
327. Hicks Withers, Dundalk, Ireland—Improvements in horse shoes.
328. Griffith Jarrett, Poultry—An improved apparatus applicable for marking linen, and for other printing and stamping purposes.
329. David Ker, Plymouth, Devonshire—Improvements in the construction of submarine telegraphic cables, and in the means of protecting the same from undue strain, or wear and tear.
330. John L. Jullion, Tynemouth—Improvements in the treatment of soda waste and sulphurets.

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

II.

If our contemporaries "have writ their annals true," the most extraordinary delusion of the age, is certainly the Armstrong gun. The authorities of the Board of Ordnance, after numerous experiments upon that invention, have handed themselves over unreservedly to Sir Wm. Armstrong, and have spent an enormous sum of money on the application of his system; besides placing him in the unfair and invidious position of judge over all future inventions of a nature to compete with his own. The outlay for remodelling our artillery upon the new system, has avowedly already exceeded £1,500,000; and various factories are even now in full work preparing guns under Sir W. Armstrong's directions, at a cost which, from past experience, we may anticipate will not be much less than £2000 per gun. Yet, on the 20th of March last, it appears that a single shot from an old-fashioned 9 pounder gun, at 100 yards distance, striking one of the 12-pounder Armstrong's in front of the trunnions, completely destroyed the latter, breaking through both the coils, and causing the muzzle to drop 12°; a second shot completely broke up the gun, whereas the 9-pounder was still serviceable, after having been hit six times! A weapon of this former kind is manifestly unfit for the purposes of modern warfare; but how does it happen that the discovery of its defect only comes when the money has been spent? It is the duty, at least we as tax-payers feel it to be so, of the very fine gentlemen of the Ordnance office to enlighten the public on the real merits of the case, for at present the story of the failure of our new artillery does not come before the public in any authentic form; yet when the *Mechanic's Magazine*, the *Engineer*, the *Nautical Magazine*, publish such statements, a notice of them is required. The public has a right "to know how the money goes;" and this is the more true in the case before us, because it seems that General Crofton and Major Hay have presented confidential reports to the Government, in which they call attention to the failure of the Armstrong guns in the last Chinese campaign; and because in the *Moniteur* of the 25th November, 1860, M. Penguilly L'Haridon, of the French Artillery, who served in the Chinese expedition, and had an opportunity of comparing the Armstrong and the French rifled guns in actual service, expressed a very decided opinion with respect to the superiority of the latter. Common report says that the Armstrong shots strip in leaving the guns, and spread such havoc among the men serving them, that on some occasions in China, they were absolutely removed from the front; and another report is abroad, that the Armstrong guns already made are about to be hooped with steel. Surely this matter is serious enough to merit more than the passing attention of the guardians of the public purse.

The Report of the Royal Commission upon the constitution and management of the Admiralty has lately been published, and it proves, amongst other things, that the Government has been as unsuccessful in the economical manufacture of its ships, as it seems to be in its manufacture of artillery. It would indeed be impossible to conceive anything more painfully unsatisfactory than the present state of our dockyards; and though the attempt to introduce the element of private competition failed, in the case of the gun boats (for reasons which are tolerably well-known, but which no one has yet been bold enough to allude to openly,) yet the gross confusion and jobbery of our dockyard system, must ultimately drive our Government to resort to the former. It is monstrous that a branch of the public administration should not be in a position to control the expenditure of its operations in such a manner as to enable it to state the cost of any one of them; and that the Surveyor of the Navy should not be able to depend even on the quality of the materials he orders to be employed. The Government had better at once cease to build ships, if these abuses be inherent to its operations; and at any rate, it is evident that a private ship builder, who should conduct his business in the same manner as the Admiralty does, would soon find his way into the *Gazette*. A radical reform of the whole system of the Royal Navy seems to be the only course open to us; but so long as the present "influences" are at work upon our legislature, there can be little hope of such a reform being made in spirit and in truth; anything short of this, however, will but lead again to failure and disappointment.

It would seem from the Report of the Light House Commission, equally with the one of the Admiralty Commission, that the panacea for past misgovernment is believed to lie in the centralisation of the various departments of the public service. The results of the inquiry into the management of the light-houses on our coasts, certainly proves that there are at the present day many anomalies, and many dangerous varieties in the details of this important branch of the public service; and for our own parts, although we are decidedly opposed on principle to anything like centralization, we cannot disguise from ourselves the necessity for introducing a far greater degree of uniformity in the management of our light-houses and buoys, than has hitherto prevailed. Herein, however, lies the difference between the conclusions the commisioners have arrived at, and our own; they call for centralisation of administration, we hold that uniformity of system is all that is required. It is very objectionable that one code of signals should prevail in one port, and another in a second, or that the buoys in Liverpool should be painted in a different manner from those of Dublin? But it is absurd, we think, to suppose that any "Trinity Commissioners for Lights," consisting of the Astronomer Royal, the Hydrographer of the Admiralty, and the Comptroller-General of the Coast Guard, should be able to direct operations, which affect local interests so seriously as the lighting and buoying of our coasts and rivers must do, with the necessary degree of promptitude and energy. Setting aside, for the moment, the consideration that the officers thus named have already to perform duties which are more than sufficient to occupy the whole of their time and attention, and that on several occasions when the Astronomer Royal has been called upon to advise the Government in matters connected with practical science, he has simply embroiled them; setting aside these considerations, it must be notorious to all who have watched the proceedings of Government administration, here or elsewhere, that it is impossible to make any central board move with the rapidity or intelligence of local wants and of local resources required for a service of the particular nature under consideration. Much of the confusion of our present lighting and buoying system arises from the slow growth, and the peculiar tenure of the lights under private or local authorities; and great good would be effected by the extinction of the private interests connected with them; but to substitute a Government (and practically an irresponsible) Board, for the authorities who now exist, would simply be to replace King Stork by King Log—a change we believe to be by no means desirable, for King Stork now thrives precisely in proportion as he renders navigation safe. No doubt the French "Commission des Phares" performs its duties in a far more efficient manner than our Trinity House, or other analogous bodies; but it is to be observed that the members of that commission are directly nominated by the Minister of Works, who presents their Budget, and is responsible for their acts. The Board proposed for our adoption would be independent of any responsible minister, and it seems to us singularly removed from the influence of public opinion. Even in France, however, improvements in lighting are only adopted with difficulty. In no case is coal gas there used as the illuminating power—electrical light is only now about to be tried; floating lights can hardly be said to be known by our neighbours, notwithstanding the existence of moveable sand banks in many of the embouchures and bays of their shores; and beautiful though the French fixed lights are, we are convinced from our own personal experience that the cost of them is superior (other things being equal), to that of our own. Be all this as it may, great good must be done by calling attention to the subject; and it is to be hoped that the Government will not allow the Report of the Light House Commission to suffer the usual fate of the blue-books.

It may be added that the French Government has lately commenced the application of electricity to eight of their first-class light houses; and that our Admiralty are still experimenting upon the same subject.

Mr Train's tramway has been in full operation in the Bayswater Road for some time, and it confirms the impression we had previously entertained with respect to it. In the streets of a populous and busy town, these tramways are excessively inconvenient, and we cannot at present perceive that they produce any economy in the cost of locomotion. The omnibuses upon the Bayswater Road, carry at the utmost thirty-six passengers, at the rate of only seven miles an hour, in a district where the traffic takes place under such circumstances as to afford little interruption to their progress, and to perform this service they require three men and two horses; whereas an ordinary omnibus carries its twenty-two passengers with only two men and two horses. It would thus appear that there is little advantage in the much be-puffed American tramways for street traffic, but the experiment in question proves that in country districts horse traffic might often be advantageously applied where locomotive traffic would not pay. It would be easy to connect outlying villages with main lines of railways by trams laid upon common roads; but in towns, these trams offer too much interference with the ordinary traffic to justify their general introduction. For the present, the result of Mr Beresford Hope's prosecution of Mr Train in the police courts will, in all probability, lead to delay in the attempts to apply the American system.

Some interest has been excited in the Engineering ranks of the metropolis, by the publication of the Report of the Bridge House Committee upon the state of Blackfriars Bridge, on account of the connection of that structure with the intended embankment of the river between Westminster and Blackfriars, and with the intended new bridges. The committee seem at last to have become sensible of the disgraceful state of the work entrusted to their care, and to have awakened to the knowledge that the projected interferences with the transmission of the tidal wave in the upper reaches of the Thames, must compromise the safety of the buildings within its influence, which were constructed during the existence of the regime of the river produced by the old London Bridge. Blackfriars Bridge is, therefore, condemned, and a new one is proposed to be erected; but no attempt seems to be made to secure a full investigation of the whole question of the engineering condition of the Thames, and the Bridge House Committee treat this question solely with reference to their own point of view. In fact, however, those navigating the river, and the proprietors of land on its banks, are quite as much concerned in any alteration of the structures in the stream as the Bridge Committee possibly can be; and if the Thames conservancy be of any real value, it must insist upon the question being examined in its entirety. The state of the Thames, and of the means of intercommunication between its banks is at present simply disgraceful; yet no attempt to devise an effective remedy seems likely to be made.

Within a few weeks, Mr Cowper has adopted a measure for the purpose of considering the state of the stone-work of the Houses of Parliament, which ought to have been adopted long since, namely, he has appointed a commission of architects, engineers, chemists, and geologists, to advise him as to the best method of arresting the decay of that building. There seems to be some strange spell hanging over the whole of the executive branches of our Administration, by which they are driven into the hands of parties of very doubtful authority in practical matters; and the whole of the story connected with the selection of this building stone, illustrates the existence of the supposed law. A well chosen commission was appointed in 1838, to report to the existing Government on this subject, and after numerous experiments, and a long and patient investigation, a particular stone was mentioned, as being the one most suited for the desired purpose, that is to say, for the erection of the new Houses of Parliament. The Bolsover stone so selected had never been tried in the peculiar atmosphere of London, and its use must always have been attended with a certain amount of risk, but during the recent discussion at the Institute of British Architects, it was stated that the stone actually selected was never employed, so that after all, the elaborate report of the commissioners may be suspected of having been converted into a means for effecting a job. On the same occasion Mr E. Barry stated that his late father, Sir C. Barry, had been ill-advised enough to advance the money required by Mr N. C. Szerelmy for the experiments which led to the application of the so-called Zopissa, which has lately figured in a very equivocal manner before the public in connection with the preservation of the stone of the Houses of Parliament, and of the iron plates of the ship *Industry*. This was an unfortunate and unprofessional act on the part of Sir Charles, for it cast over all his subsequent recommendations of Mr Szerelmy's process, the suspicion of their having been inspired by interested motives; but however it may be explained, the fact is notorious that wherever the Zopissa has yet been applied, it has not succeeded as was anticipated. Whether any other process for treating stone which has been so long exposed to absorb the principles of destruction, as that employed in the Houses of Parliament has been, is likely to succeed, is still matter of doubt. The decay of the Houses of Parliament is, in the meanwhile, proceeding so rapidly, that a serious and competent investigation into its nature and causes, was imperatively called for.

We have lately received a sample of what is named by its inventors, a marine metal, which looks very much like an alloy of lead with some other metal which gives it singular powers of ductility and resistance to extension. No particulars of this metal have been furnished, nor have we yet been able to have it carefully analysed; but it certainly appears to render very great service in the building arts at least. For the sheathing of vessels, we should fear that if this metal were employed, a galvanic action might be established between it and the copper or iron fastenings, which would be destructive both to the fastenings and to the woodwork around them. We purpose to follow up this investigation of the action of feeble doses of salts or of acids in solution upon metals, because its importance is making itself felt more and more every day in the arts of mechanical engineering; and the recent observation by M. Carre, that brass after a short immersion in a cold ammoniacal solution became as friable as clay, confirms our opinion as to the great interest and the wide range of the question. The immense sewerage works going on in the metropolis will shortly force engineers to study the subject, for the chemical nature of the sewerage waters must have some decided action on the metals exposed to them. There is another problem connected with this branch of science in an indirect manner, viz., the economical application of the sulphate of zinc; for it is found that the production of one horse dynamical power by galvanic electricity can only be effected by the conversion of 4½ lbs. of rolled zinc into the sulphate, and thus, until some economical application of that article be discovered, the electrical power can never be advantageously applied. In saying even this much as to the possibility of the application, it must not be suspected that we consider it likely that zinc could ever be obtained in sufficient quantities to supply any great demand of the kind referred to; but in exceptional cases electricity might be substituted for steam, if the cost of the source of power were reduced.

UNITED STATES PATENT LAW.

An Act of Congress has recently been passed, which effects important alterations in the patent law of the United States of America. By the new act, the distinctions which have heretofore existed in the amounts of the fees payable by native Americans and by aliens, and by the operation of which, British subjects taking out patents in America were charged at a higher rate than other foreigners, are altogether abolished, and one uniform scale of payments is established. These payments are considerably less than the old fees formerly demanded, the effect of the alteration being to reduce the cost of an American patent from £125 or £150, to £30 or £35. Moreover, a patent, when obtained, will be good for seventeen years instead of fourteen years as at present, but as a set off to this indulgence, no extension of the term of ordinary patents is to be hereafter granted.

The Act also extends the facilities afforded in the United States for protecting articles of design, both with regard to the subjects to which designs may be applied, and the term for which protection may be obtained. On the latter point the alterations are very important. By the old law, protection for a design was granted in every case for seven years, and no opportunity was afforded to an inventor to obtain any extension of his protection. By the new law, such protection may be granted for a period of three and a half, seven, or fourteen years, at the option of the applicant, on payment of fees amounting to 10 dols., 15 dols., or 30 dols., as the case may be, and extensions of the term of design patents for a period of seven years may be obtained in proper cases.

The Act further requires that in every case where an article is made or sold under the protection of letters patent, the person so making or selling it, shall give notice to the public of the existence of the patent by affixing to the articles, or the wrappers in which they are sold, the words "patented," and in default, the patentee is debarred from recovering damages for any infringement of his rights, unless it shall be proved that the infringer had notice of the patentee's rights, and continued to infringe after the notice had been received.

Alterations are also made in the proceedings necessary for obtaining patents, some of which appear to have been made with a view to the convenience of intending patentees; as, for instance, the rule requiring a model to be in all cases deposited, is varied, and the model may be dispensed with in patents for designs, whenever the design can be properly described by means of a drawing, and the English practice of printing specifications, which are to be legal evidence, is also introduced with modifications. On the whole, the Act appears likely to prove of considerable advantage to inventors.

ON THE EXISTING STRIKES.

The most important subject, for the consideration of all persons interested in practical mechanics, which is now before the public, is unquestionably the one connected with the disputes between masters and workmen; or, in other words, with the relations between labour and capital. At all times, disputes of this nature must have existed, and must exist, for human passions are eternal and uniform in their action; and so long as the one party has to sell its services, and the other to buy them, so long will there be a danger of collisions between the respective interests. There is nothing anomalous, therefore, in the fact that masters and men should, at the present day, entertain very different opinions as to the value of labour, or as to the regulation of the modes of its employment; and it may even be suspected that the very disputes themselves are indications of national vitality and prosperity, because they would not occur when distress was universal, or when the minds of the labouring classes were discouraged or depressed. If, then, the recent strikes had depended solely upon the conditions of demand and supply, or if they had been confined to the object of removing the local interferences with the exercise of men's talents, skill, and industry, there would be little reason for regretting their occurrence, and they might fairly have been left to settle themselves. But the declarations of the leaders of the recent strike in the building trades of the metropolis, contain indications of the desire, on the part of the more influential members of those trades, to introduce a new species of social organisation, and to interfere so seriously with the individual liberties of their own class, as to challenge the most serious attention, not only of the employers of labour, but also of every member of the body politic. It is to be feared that, in the eyes of the labouring classes, these questions are no longer mere economical ones—they have become distinctly social questions; and unfortunately the London builders seem to have adopted some of the worst and most fatal doctrines of the so-called socialist school, which inflicted such incalculable misery on France in 1848.

Mr Potter has, indeed, distinctly avowed that the objects for which the present strike has been entered upon, are 1st, to ensure the equal distribution of the existing amount of work, amongst the greatest possible number of men, by shortening the hours of labour; and 2d, to oppose the introduction of any arrangement by means of which individual members of the trades might exert their own abilities for their own benefit to the detriment of the principle of an equal distribution of employment, by prohibiting piece-work or over-time. For the present, it would seem that these objects are considered to be of greater importance than the money rate of payment; and it was avowedly on the pretext that the proposition of Messrs Lucas and Kelk to pay an advanced price per hour worked, was likely to interfere with the distribution of employment, that their men were ordered by the Central Committee to leave work. This is, in fact, part and parcel of the system which fixes the number of bricks a labourer is allowed to carry in his hod, which forbids a bricklayer to use both his hands whilst laying bricks, or which limits the maximum amount of labour of any kind a workman may do in a day—a species of inverse piece-work, in which men are supposed to be paid rather according to what they do not do, than according to what they do. It has been justly said that upon these principles the best workmen are reduced to the level of the lowest class of their fellows, for it must be impossible for any of them to rise in the estimation of their employers, by the exercise of greater industry or skill, and the power of doing an exceptionably large quantity of work in a given time, instead of being an advantage to a man who has to live by his labour, becomes, on the contrary, a source of obloquy and of reproach. Like all socialistic equalitarians, Mr Potter, and the bulk of the London builders we fear, are anxious not to raise the standard of the merits of their class, but to pull the better men down to the level of the idle and incapable; and in their endeavours to effect this chimerical object, they do not hesitate to destroy the liberty of individual action of their colleagues, so strong is the moral compulsion, so violent the intimidation they bring to bear upon any unfortunate workmen who dare to think and act for themselves. We talk loudly about the diffusal of education, and the per centage of children who frequent schools causes newspaper writers to shout with joy; but alas! it is to be feared that of late years we have been confounding instruction with education, and that, whilst we have been teaching the rising generation smatterings of science, we have neglected to instruct them in the knowledge of their rights and duties. Such monstrous doctrines as the one maintained on the occasion of the last London strike, viz., that *because* machinery was being introduced in building operations, *therefore* the workmen ought to combine to keep up the value of hand labour, could only have commanded the assent of large bodies of men when they were profoundly ignorant of the laws of political economy; and the measures adopted to force the capitalists to recognise this doctrine, could only have been carried into effect by men who were utterly ignorant of their own moral duties, and were ill-disposed to tolerate the exercise of the rights of others.

It is this ignorance of their real duties, and, therefore, of their real interest, which constitutes one of the great dangers of the working classes, and of society in general, at the present day. The former do not seem to be aware that when they sell their time to a capitalist, as they are pleased to call their employers, they virtually undertake to give the latter the results of their best skill and labour during that time. Any limitation, by arbitrary trade rules, of the amount of work to be done in the time so sold, is neither more nor less than robbery; and it is sad to see that our workmen are not able to understand the real character of the course they have embarked in, so far as these trade rgulations are concerned. It may be that a certain mental effort is requisite to enable ordinary minds to perceive the truth of moral problems; but it is startling to find that the best intellects amongst the building trades should consent to forego the advantages they might derive from the exercise of their own abilities; and that the best workmen should willingly place themselves in the same category as the worst. If this system prevail, how is any man to rise? Have the doctrines of equality been productive of so much happiness elsewhere, that our workmen should sacrifice their right of doing the best for themselves, and of selling their labour in the best market? It is common enough to cry for "liberty and equality," and the leaders of the building trades seem to have adopted these words as *their* cry; but the results of all attempts to reconcile those abstract properties of our race, have hitherto only led to disappointment and misery. Men are not born equal, and if free, they will soon find their respective levels: if kept equal by any social arrangement, they cannot be free. The whole theory upon which the leaders of the building trades now act is radically opposed to the laws of the constitution of the human mind; yet so strangely fascinating is the doctrine of equality to the unreflecting, that at all times it has been able to secure the adhesion of the masses. Most urgently do we, in our small way, appeal, however, to the working classes and urge them to examine these things for themselves, rather than through the blind leaders now set over them; because we are convinced that a very little reflection will lead them to the knowledge of the mistake they have made by their hasty adoption of the principle of controlling the free exercise of labour, and that the rights of one section of their class cannot be compulsorily enforced without seriously interfering with the rights of the remaining classes. As it happens, the whole body of the working classes in the building trades are sacrificing themselves for the benefit of the idlest and most incapable of their colleagues.

The period selected by the London operative builders for their present strike, is singularly ill chosen and inopportune. The men can hardly have recovered the effects of the last severe struggle; the masters cannot have lost the organisation by means of which they were able to secure their temporary victory. During the last winter, moreover, the severity of the season must have exhausted much of the resources of the men; and, at any rate, public opinion is roused against the folly and the ingratitude of a class which, in January, did not hesitate to cast itself upon public charity, and in March, refuses to work at high wages, solely because the masters will not consent to an arbitrary limitation of the hours of labour. The folly of the course adopted by the men is in fact only equalled by its absurdity. They will meet with little support beyond their own ranks; and they may depend upon it that the surest result of their recent movement will be to introduce a new class of competitors, in the shape of foreign workmen, or to develop the application of machinery in the preparation of many of the details of building. Hitherto the London builders have paid little attention to the capabilities of the continental labour market to supply their demands, and there are few of them who are aware of the excellence of the French, Belgian, and Spanish masons, of the Belgian and Dutch brick-layers, or of the French and Belgian smiths and engineers. As these men receive at home, where the primary elements of living are even more costly than they are in England, wages ranging from 40 to 60 per cent. less than are paid here, they would no doubt easily be persuaded to emigrate—to the great benefit of their own home labour market, be it observed. New materials, new processes of construction could, moreover, be easily introduced, and our operative builders might learn from the experience of the past, were they coolly to examine all the bearings of their position, that it is a suicidal folly to hold out a premium for the discovery of means for avoiding their employment by their own unreasonable demands.

The strikes which have taken place in the provincial towns, do not seem to bear so strongly marked a socialist tendency as some of the building operatives of London; but virtually, they are inspired by the same desire on the part of the leaders of the workmen, to regulate the conditions of labour, as in the latter case. The universality of the feeling which prompts this desire, no doubt, proves that the present relations of capital and labour are not such as they ought to be; and the utter ignorance of the operatives of the real principles of social science, proves that the masters have failed in their duty as teachers and leaders in the intellectual progress of the age. It were well for all parties if these sad disputes caused men to think earnestly upon their respective duties and rights. As a general rule, however, when passions are excited, the former are forgotten, and attention is fixed solely on the latter.

THE INTERNATIONAL EXHIBITION OF 1862.

The arrangements connected with this great undertaking are progressing with great rapidity. A royal charter, incorporating Earl Granville, K.G., the Marquis of Chandos, Mr Thomas Baring, M.P., Mr C. Wentworth Dilke, and Mr Thomas Fairbairn, commissioners to conduct the Exhibition, has passed the Great Seal, and it may be useful to our readers to state briefly what are the powers of the commissioners under that charter. After reciting the prayer of the Society of Arts, and constituting the commission, it proceeds to state that for the purpose of enabling the commissioners to carry out the Exhibition it is necessary that they should be enabled to borrow the sum of £250,000. This they are empowered to do upon a deed of guarantee being signed for that amount. The funds borrowed are to be expended on the erection of such building as may be necessary, and in the general expenses attending the enterprise. Of the building to be raised one acre only is to be of a permanent character, and upon this portion the sum of £50,000 is to be expended in its erection and completion. Should the Exhibition be attended with a profit, in this case the permanent building is to be vested in the Society of Arts, and used by them for purposes tending to promote arts, manufactures, and commerce; but in case of a deficiency at the close of the Exhibition, the Society of Arts to have the power to claim a lease of the same upon its undertaking to pay to the commissioners such money as the buildings would be likely to realise if taken down; but in case the Society of Arts should not claim a lease, then the commissioners are to sell the one acre of permanent building, and to convert into money all properties and effects belonging to them, which can be sold and converted, particularly all the buildings erected by them for the purposes of the undertaking. Should there, however, at the close of the Exhibition, after payment of all liabilities, be a sufficient surplus of profit remaining, then the one acre of permanent building is to be completed and the land retained for the purposes of a future Exhibition, by the payment of £10,000 to the Royal Commissioners of the Exhibition of 1851, on whose land the Exhibition of 1862 is to be placed, and all further profits are to be applied to such purposes connected with the encouragement of arts, manufactures, and commerce, as shall be determined by the guarantors at a meeting to be called for that purpose. Such are the general powers of the commissioners under the charter, and the guarantors cannot therefore be called upon for contributions under any condition, except a deficiency remains after every description of property belonging to the commissioners has been converted into money. Since the charter passed the Great Seal the commissioners, in a letter addressed to Sir Thomas Philips, Chairman of the Society of Arts, state that they gladly accept a charter, which conveys to them Her Majesty's gracious assurance that she is earnestly desirous to promote the holding of an International Exhibition of Works of Industry and Art in 1862, and they, being unwilling to lose valuable time, have taken such provisional steps as their position permitted, and have therefore considered the most pressing point—namely, the building required for the Exhibition; and have come to a final decision as to the character of the building intended to be erected for the Exhibition of 1662, and will be prepared from time to time to advance the necessary funds. Messrs Kelk and Lucas, the eminent contractors, who sent in the lowest tenders, are proceeding with the erection of the building. It is also stated that the commissioners have received the assurance of the French Government of its support of the Exhibition, accompanied by the statement that it had been the intention of the Emperor to hold an International Exhibition in Paris in 1862 had the project not been entertained in England. The Duke of Newcastle, Secretary of State for the Colonies, has addressed a communication to the Governors of Her Majesty's colonies announcing the intention to hold the Exhibition. In England some of our largest manufacturers are already actively engaged in preparing for this second display; and we may expect to see our great seats of industry actively engaged in preparation and anticipation of the competitive display of industry and art to be exhibited in 1862.

HEAT IN ITS RELATION TO WATER AND STEAM.

Energy is a function; and its immediate indications in bodies depend on the atomical structure of the mass: thus two bodies whose energies are equal, the bodies are then equal to one another.

When two bodies differ in energy, the one continues to absorb from the other until they become equal. Sensitive energy induces energy in all bodies within its sphere of action.

When a body is acted upon by energy, a progressive change takes place in the structure of that body, the change being expansion or contraction; so that these bodies may possess active energy without indicating sensitive energy—this depending on the condition of the mass: energy in equilibrium is latent, when not in equilibrium, it is sensitive.

Let us now examine the difficulty which prevents Mr Dyer from admitting the principles of the mechanical theory, more particularly those advanced by Dr Joule. Mr Dyer informs us that he experimented with "a closed cast-iron box, containing about a cubic foot of water, and had a friction cylinder mounted in it, so as to be driven at different velocities at will. A statical pressure of plus three atmospheres was applied to the enclosed water. Then, taking the respective *sums* of the *pressing surface* (between the cylinder and the water), the velocities and times of action, the moving force employed, and the temperatures of the water before and after each trial, it was clearly proved that the assumed 'laws of equivalents' as between the mechanical forces employed, and the degrees of sensitive heat raised in the water, could not be made to apply to those experiments; for the heat indicated did not exceed 2° in the *water*, whilst the force expended should have raised it to a *boiling heat*, according to that law."

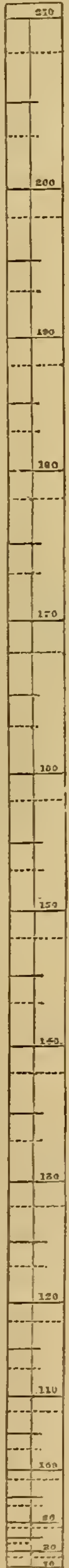
A fundamental principle in fluids is, that they have the property of pressing equally in all directions when pressure is applied to their surface. Mr Dyer informs us that he had a pressure equal to three atmospheres pressing on the fluid. It will be evident that we have here two conditions—first, that of equal pressure, and second, that of forced pressure—so that each molecule has an equal and contrary pressure in every direction, the mass being a combination of forces equal to 45 lbs. on the square inch This then is the condition of the fluid experimented upon—an energy of heat equivalent to 45 pounds, would be 275°, therefore we need not be surprised that the water experimented upon did not boil, as the physical energy of the pressure would require to be overcome before the piston could be expelled from it. Although it might gradually begin to ascend by the expansion of the water, the effective power in pounds per square foot, or the effective work in foot pounds performed by the fluid during expansion; so that the law as deduced by Dr Joule, "Heat and motive power are mutually convertible, and heat requires for its production, and produces by its disappearance, motive power in the proportion of 772 foot pounds for each Fahrenheit unit of heat"—this law is not in the least impaired by the experiments referred to, when we keep in view the density or pressure of the water; but as Mr Dyer has not given the particulars as to the amount of friction and energy or power applied, we cannot further examine his experiments with water. If his experiments have been made with due care, instead of disproving the dynamical theory, I have no doubt they would be found to substantiate it, when the above conditions are kept clearly in view, and they would be useful in assisting us to form an idea of the amount of physical energy required in raising heat under a pressure of 45 pounds, as there can be no doubt that more than one formula is required for a thorough practical working out of this important question.

It may be well that I now point out what seem to me defects in the theory held by those who maintain the opposite side of this question.

The great discovery of Dr Black of latent heat, does not give us a solution of the question, but simply facts from which we have been able to infer the probable amount of energy or heat which is required to sustain the fluid in the vapour form; it does not explain to us by what law heat, which was sensitive, has passed into the latent state, and then reappeared in the sensitive. On the principles advanced in the preceding paper, we have no difficulty in forming an idea, when we apply the magnetical laws of energy or force; and by the same laws we can fully anticipate the various conditions of matter that induce the specific heat of bodies. As to the elemental views held on this great question of heat being within the pores of matter, and by others, as forming atmospheres round each atom, so that each atom is required to be imponderable, this view does not by any means assist in the investigation of this question, for it implies rest under certain conditions which is the opposite of energy; and if energy be a quality of matter existing within the pores, or forming an atmosphere round each atom, the whole universe of matter must long ere this have undergone a change.

On the other hand, we can conceive of certain conditions or arrangements of matter which are conducive of being acted upon by energy, but not the matter of itself producing energy.

It has been affirmed by writers who reason this question on the atomic theory, first, that the *atom must be imponderable*, and that the subtle fluid diffused throughout matter, is only to be conceived as surrounding the atom; also, a certain amount of space being necessary to the existence and action of heat upon the atoms. The first point for us to examine is, is it necessary that each atom must be imponderable. We enquire for what reason must it be so? Because the subtle fluid is required to surround the atom. This, then, reduces the question to two conditions; that is, the atom is imponderable and enveloped by a fluid. Then, by what process of reasoning is it affirmed that it is so? Because they say fractional parts of an atom is a condition of matter not to be recognised. This seems an easy way of answering the question; but is it satisfactory? It will be evident that the imponderability of the atom is a consequence of the idea arising from the subtle fluid being required to envelop the atom; so that the imponderability of matter need form no part of the controversy, but it is evident that matter must be of that property to harmonise with the theory, so that the subtle fluid may form no part of the atom, but act upon it.



The question now is that of the fluid. How is it? and what is it? Those who claim for it substantial properties, assert that it is diffused throughout matter enveloping certain conditions of atoms, and in other conditions of matter, residing in its pores. Centuries have passed, and each record endeavours to measure and define this subtle elastic fluid. At times its solution appeared at hand, then its supposed existence was found to be a combination of matter, the basis of which was already known. We have been told that it is *intense chemical action*. This is not the answer. What we want to know is, the *nature* and *cause* of that chemical action. Whatever views may be held on this important question, must not be inconsistent with any of the known laws of nature. Any of the elemental theories, so far as I know them, seem far short of the solution.

On the other hand, when we reason of but one great atomic power pervading matter, and that energy subordinate to intelligence, we can dimly perceive the cause of those varied motions in inert matter, and thereby anticipate the various changes throughout matter. This agent we call *electricity*. It is not necessary that we speculate on the divisibility or abstract forms of matter; and throughout these papers I have studiously avoided extreme calculations, believing that they have a tendency to mystify rather than advance our knowlege.

There is one important condition of matter, in what may be termed its natural state, which we cannot well pass over; that is, why contraction when energy or heat is applied? To pass it over without offering an opinion, would be a shirking of the question. The illustrious Dalton, in his conception of the mechanical construction of water and gases, says, "A vessel full of any pure elastic fluid, presents to the imagination a picture like one full of small shot. The globules are all of the same size; but the particles of the fluid differ from those of the shot, in that they are constituted of an exceedingly small central atom of solid matter, which is surrounded by an atmosphere of heat of great density next the atom, but gradually growing rarer, according to some power of the distance; whereas those of the shot are globules uniformly hard throughout, and surrounded with atmospheres of heat of no comparative magnitude." However much the first part of this may assist our ideas, the latter part we cannot well conceive, of globules uniformly hard throughout, surrounded by an atmosphere of heat of no comparable magnitude. If heat be a material element, it must have magnitude, for it is supposed to form an atmosphere round the atom, hence, occupying space. M. D. Saussure informs us that when on the Alps, in a mist which passed over him, it was formed of globules, each as large as a pea, and on examining he found them to be hollow and inconceivably thin. Now, the question arises, are each of these globules made up of an infinite series of globules, each surrounded by an atmosphere of heat? This we cannot well conceive. We have no analogy to assist us; but we do know that these vesicular formations are charged with electricity, causing them to repel each other—this repulsion, for the time, preventing their union, and forming rain. The question naturally arises, whence is this electricity? was it associated with it in the fluid form? We say, yes; and believe it to be the cause that induces the various changes in matter, and that this energy pervades matter, so that we do not require atmospheres of heat surrounding its atoms or filling its pores, and by its agency matter undergoes changes of relation and condition, which each atom in its turn records or communicates to another, the former having undergone a change in its course, thus governing or regulating the whole. We infer when a dominancy of energy takes place, that matter must undergo a change. It is not necessary that that change be expansion, because change may involve contraction as well as expansion. Thus, then, the matter which composed the fluid undergoes a change. The first indication with water; when energy or heat is applied, is contraction, then expansion. This being the case we now proceed with the enquiry. Increasing energy moves atom after atom, at first slowly, then more rapidly, by each increasing as it passes on, giving energy to that which preceded it, the atom rebounds, returns to the fluid, and again rebounds with increased energy, until its force in that particular form become expended, the matter again contracting and returning to its former condition, to again pass through the same course. Thus, we perceive in the heating of water, when energy has caused the expansion, the air contained in the water gradually becomes relieved, and ascends to the surface, uniting its energy with those that preceded. As the energy increases, the pressure increases in a similar proportion, and when equal to 30 pounds, the water, when examined by a powerful magnifying glass, presents to us spiral curling clouds, which seem formed of myriads of atoms pressing and repelling each other, passing to the surface, rebounding, descending, and returning with increased energy. May we not inquire, why this rapid and cloud-like motion, and increasement of distinctive atomic forms—each atom to the eye appearing dim, as the pressure increases, may we not enquire are the atoms which compose the water changing their axes in passing to the gaseous form? If so, we thus perceive the electric influence, acting upon the water, and inducing the gaseous hydro-electric, combining in power, and ever ready to transfer it to the ponderous piston of the steam engine, thus giving its rebound, and then returning to its former condition.

It is only by comparing things with one another that we can form correct ideas; so, when we endeavour to extend our ideas, we must keep clearly in view known principles. I am not aware of any law that we are conversant with, which assists us in forming ideas of heat existing either in the pores of matter, or forming atmospheres round its atoms. We cannot conceive of gases forming any analogy by which to support an elemental theory of energy. But I think we may assist our ideas in this way. On the table at which I am writing is suspended a magnetic needle. I have asked a friend to take a magnet from another apartment—the needle begins to vibrate. He has now placed it upright, with its end leaning between my shoulders. In this position it deflects the needle 75 degrees. This energy which repels it has passed through my body, yet that influence impedes not the circulation of that fluid which moves throughout my system, which is itself impelled onwards by a similar influence. Thus, then, is energy impelling and pervading without forming a quality of my body. In a similar way, we may connect the hand with the galvanic wire, and with the other again attract or repel the pole, the energy having passed through the body: and by the same wire and gentle touch, we may in an instant, by the same energy, repel the needle thousands of miles distant. By the same wire we may explode the deep sea rock, and melt as wax gold and platinum wire, and light up the charcoal points to a brightness only second to the sun, so that the theory of energy rests not on phantom dreams, but on realities.

THE FEEDING OF BOILERS WITH HOT AND COLD WATER.

Before offering any opinion on this question, let us enquire from practical experiments, so that we may be in possession of a few facts, the knowledge of which may prevent us from forming false conclusions.

In a former paper, I have referred to the contraction and expansion of water. Since then I have repeated many of the experiments, and the results have strengthened me in the opinions I at that time advanced. The former experiments were made with a large glass thermometer. Knowing the glass to be a non-conductor, under certain conditions, I procured another thermometer with a ball made of thin sheet brass similar in size to the one of glass. Attached to the ball was a glass stem, the bore similar to that of the other, so that the thermometers were as nearly alike as possible. The two were then fixed in the large semi-circular boiler. (See article I.) The lamps were then lighted. The first indication was contraction, while the mercurial thermometer was gradually rising. The water in the brass thermometer began to ascend in about 2½ minutes, and that in the glass thermometer in about 3 min. 35 sec.: when the mercurial thermometer indicated 100°, the brass thermometer indicated 95°, and the glass about 89°, and they gradually approximated, and at 200° they were both equal—the mercurial still indicating between 2° and 3° higher. This difference was observed by passing a small thermometer down the stem of each. From this there can be no doubt that the difference indicated at first can be traced to magnetical causes. When the thermometers were filled with water the first time, the air contained in the water was much more freely relieved from the brass thermometer: the air bulbs would at times measure 9° or 10° of the scale. In the glass they never exceeded 4° or 5°, so that the first scale formed was very irregular, particularly the one from the brass. In the glass they were more regular, and very small. In the brass the air seemed nearly discharged at 180°; in the glass they continued till 212°. The engraving on the side will convey an idea of the difference of the expansion of the water when heated the first time. The solid lines indicate the first expansion, and the dotted lines the expansion when boiled the second time, thus conveying an idea of the amount of air expelled, and just in proportion as the air was expelled, a greater amount of heat was required to raise the fluid to the boiling point. I am aware of many statements as to the amount of heat which is required to raise the pressure after the air is expelled; but so far as I have tried, the greater number of these statements go far beyond that required in any of my experiments. One thing is certain, we require much more heat after the air is expelled than when the water is heated in its natural condition.

PAUL CAMERON.

MOVING CYLINDER STEAM HAMMER.

By Messrs Bain & Wylie, *Shields Iron Works, Glasgow.*

Illustrated by Plate 272.

In the *Journal* for December last it was our sad duty to have to record the sudden death of Mr John Condie. In the person of this gentleman the mechanical world lost a valuable contributor to the commercial wealth of this country, for it is to Mr Condie we owe the practical carrying out of the Hot Blast apparatus, as well as the Water Tuyere, the use of which has become so general. Valuable, indeed, as Mr Condie's Steam Hammer Patent proved itself, still there can be no doubt that, had the water tuyere been protected by letters patent, he would have realised a princely fortune by it. The practical application of the hot blast, and the valuable assistance derived from the steam hammer, have indeed contributed more than anything else to the amazing development of our iron trade. Without these now indispensable adjuncts to the manufacture, the present position of the trade would be widely different to what it is. Mr Condie's career offers a bright example to our rising mechanics, as showing what may be accomplished by a steady course of persevering industry. We survey with feelings of admiration and esteem his progress as a workman, a lecturer on natural philosophy, and then as an inventor, and at all times an earnest promoter of Mechanics' Institutes, and of philanthropic works of a kindred character. A short period before Mr Condie's death, he had transferred to Messrs Bain & Wylie the business of making steam hammers under his patent, the latter gentleman having, as we understand, for many years prior to this arrangement, conducted Mr Condie's business; and we feel assured, from the exertions which these gentlemen are making in their professional arrangements, that the importance of Mr Condie's invention will suffer no diminution at their hands.

Our present plate is similar in design to the 6½-ton hammer illustrated in the Journal for August, 1857, with the exception of the self-acting valve gearing, which experience has proved to be unnecessary for hammers of this class. Figs. 1 and 2 are front and side elevations of a 5-ton hammer, designed for forgings of the largest class, the framing consisting of two vertical cast-iron columns of rectangular transverse section placed 16 feet apart, and bound together laterally by a strong horizontal cast-iron beam, through which an opening is made for the passage of the cylinder or hammer block. These two lower columns are surmounted by a pair of segmental frame pillars, which, conjoined, form a complete open semi-circular arch, springing up to a height of 23 feet from the floor line. These semi-circular pillars are joined together at the crown centre, by internal flanges leaving sufficient space to receive the entablature and part of the valve gearing. The upper and lower columns are jointed to each other internally, in spigot and faucet fashion, their junction flanges being firmly secured by strong bolts and nuts. The upper columns are also secured to the horizontal beam by two massive malleable iron stays. The vertical guides for the cylinder traverse are fixed to the horizontal beam, and also to the arc above, provision being made for adjusting them by means of liners. The cylinder or hammer block has a stroke of 6 feet, and is cast of the strongest cold blast iron. A small horizontal steam cylinder is attached to the entablature, the piston rod of which is connected to the double beat steam and exhaust valves by a lever and link arrangement, and the attendant has merely to touch the steam slide valve of this miniature engine to raise the hammer to the desired height. The hammer complete, with anvil block and sole plate, will weigh about 80 tons, and is in course of erection at Messrs Hill & Smith's, Brierley Hill Iron Works, near Birmingham; and we have no doubt their spirited example will be followed by many other firms in that great centre of the iron trade. It has been often remarked by mechanical men, whose business avocations have led them into the various iron manufacturing districts, that in the adoption of this most useful tool the iron-masters of Staffordshire have not kept pace with their opponents in the South Wales, Yorkshire, Newcastle, and Scotch districts. The Glasgow Iron Co., the largest producers of malleable iron in Scotland, erected a steam hammer for puddling purposes, eight or nine years ago, and so satisfied were they of its superiority over the old metal helve, and the reduction in cost of repairs, and wear and tear of steam engines, that one by one, six or seven of their helves have been replaced by steam hammers. So general has been the use of these valuable tools become, that very nearly all the malleable iron in Scotland is now wrought with them.

VITRO-METALLIC ENAMELLING.

The inventor, Mr Paris of Bercy, France, gives the name of Vitro-Metallic Enamelling to his process for the application of metallic foil in conjunction with a vitreous flux to the exterior or interior of vessels or objects made either of wrought or cast iron, and which, after having been submitted to an elevated temperature, assumes a vitrified appearance, at the same time preserving their metallic lustre.

The idea of enamelling originated from the well-known fact, that a large number of the metals will combine, in a greater or less degree, with vitreous substances. The art of enamelling was for a considerable period confined exclusively to fancy goods, jewellery, and similar purposes of ornamentation, and its application was limited to gold, silver, and copper, and to their alloys.

The Germans were the first to extend the process of enamelling to cast iron, but the enamels thus obtained were of a very inferior quality, and were very liable to crack and to become detached. After devoting a considerable amount of time and study to the subject, Mr Paris has obtained the following results:—

If very thin silver leaf be applied to a plate of sheet iron, previously covered with a vitreous flux so as to prevent oxidization, and the plate thus prepared he exposed to a brisk fire, the vitreous flux will soon melt and the silver leaf will allow it to permeate. If it be exposed for a sufficient time the silver leaf will undergo a complete change, and will become vitrified; but if the plate be removed from the fire the moment the vitreous flux commences to permeate the silver leaf, a very extraordinary plating is obtained, possessing not only the appearance and properties of metal, but also the durability and the resistance of glass. The result will be the same if gold, copper, or platina leaf, or foil be employed, or if these metals be used in a fine state of division.

The following is in substance the process employed:—The exterior or the interior of any article which has to be enamelled is first wetted with a very weak solution of gum, and then covered with silver, or other metallic leaf, or foil, or with a sufficient quantity of either of these metals in a minute state of division. If the former be used, it must be made to lay evenly, and to adhere firmly by the application of a uniform pressure. The article having been thus prepared, is then placed in a muffle heated to redness, and so soon as the object attains a cherry-red heat, it is to be removed and allowed to cool gradually. During this process the leaf undergoes a partial vitrifaction, and is incorporated with the vitreous flux. It will be readily understood that any kind of design may be produced by cutting out portions of the leaf, and by applying the metallic foil of any desired pattern or design before placing the object in the muffle.

SOCIETY OF ARTS' EXHIBITION.

The Society of Arts has again thrown open its doors for the reception, as the catalogue sets forth, of articles recently invented, patented, or registered. This is the Thirteenth Annual Exhibition, but what a falling off do we find, not only in the number of exhibitors and articles exhibited, but in the class of inventions displayed! In lieu of the three hundred and fifty models and specimens of articles of manufacture, exhibited by upwards of two hundred exhibitors, at the last exhibition, we have a sorry display of two hundred and fifty articles, from one hundred and fifty exhibitors. It is true, we do not look for quantity but rather for quality in an exhibition of this description, but when we find neither one nor the other, then indeed the case becomes serious, and should be looked into. There can be no question whatever but that both inventors and the general public would patronise these exhibitions were sufficient inducements held out, in the shape of a more extended publicity, and increased accommodation for the display and inspection of models. But what do we find?—a collection of articles huddled together in—we were going to say one of the dark arches of the Adelphi—a room in every respect ill adapted to such displays, and from which light and ventilation are all but excluded. We paid our visit, not on the first opening night, when the somewhat pressing attentions of anxious exhibitors, and the presence of a goodly company, tend to bring out one's benevolence to the fullest extent, and induce one perhaps to view things through a rose-tinted medium, but strolled in as a casual visitor, after the exhibition had been open a fortnight, in order the better to judge of the interest which it creates. The attendance was meagre in the extreme, at no one time we see more than six visitors in the room, and these seemed to be there more from idle curiosity than from any great scientific interest they might take in the inventions before them.

Taking the articles in the order of the catalogue, we may draw attention to such as most attracted our notice. Amongst these are some ingenious steam boiler furnace contrivances for preventing the fire bars from choking, by imparting a rocking motion to the bars—the invention of Mr W. A. Martin. These vibrating bars are supported on one bearer, placed at or near their longitudinal centre, and upon which they are rocked to and fro vertically by a lever handle convenient to the hand of the stoker.

Mr W. Yates exhibits a fire feeder and smokeless furnace, the coals being supplied from a hopper in front, and carried forward, as required, into the furnace, by a peculiar arrangement of sliding bars.

Mr J. L. Clark exhibits a model of Wright's arrangement of moveable fire bars, having an advancing and retiring action imparted to them by a lever in front of the dead plate.

Mr S. Bateson exhibits models of his feed water heater and safety tubes, of which drawings and descriptions have already appeared in our pages.

Plate. 272.

MOVING CYLINDER STEAM HAMMER,

BY MESSRS BAIN & WYLIE,

SHIELDS IRON WORKS, GLASGOW.

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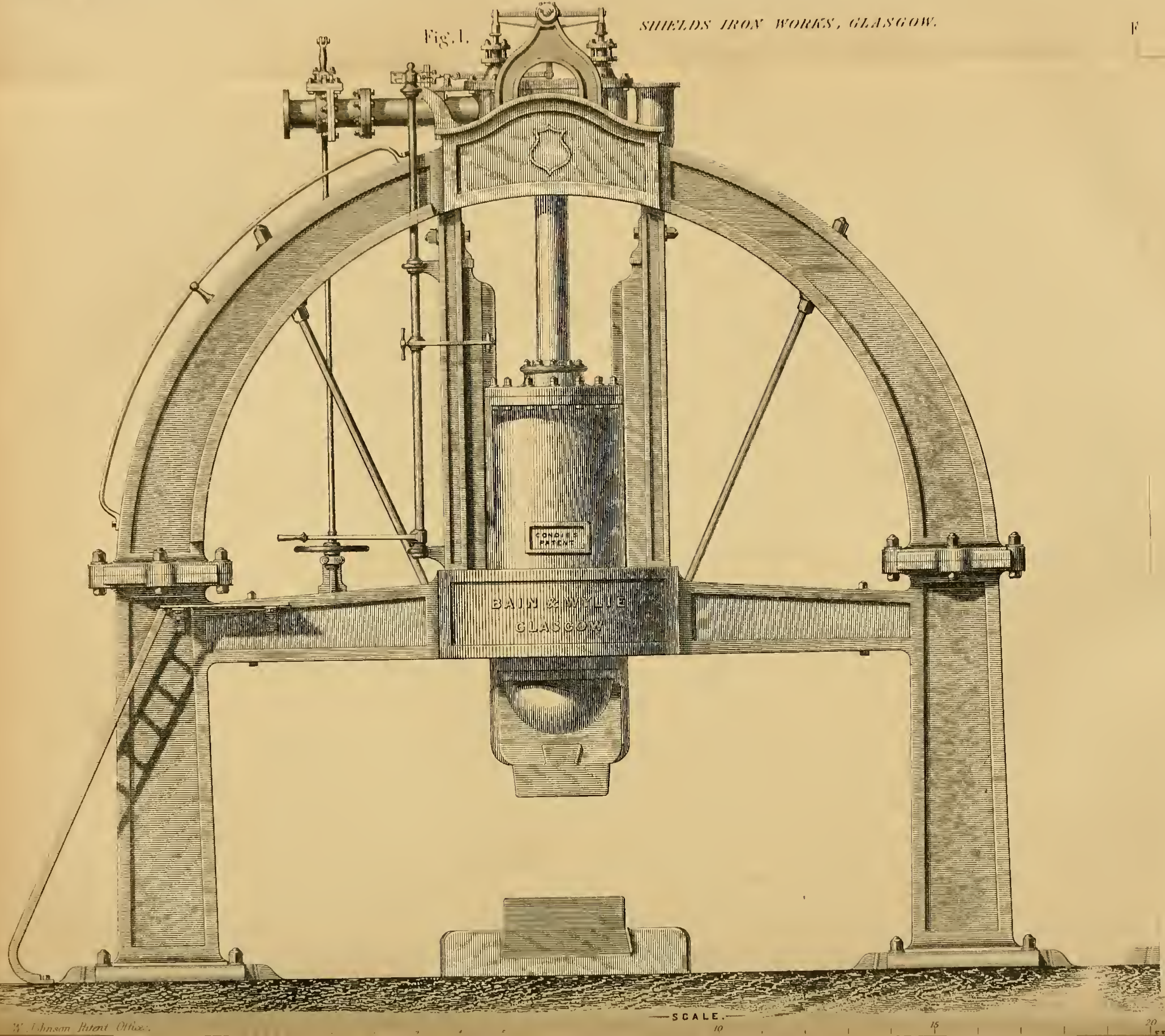
Fig. 1.



W. Johnson Patent Office.

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Mr James Chandler, and Messrs Pullan, and Cresswell appear to be rival exhibitors of patent flat glass water gauges; there is little to choose between either make, and we can safely reccommend both as being a very considerable improvement upon the old glass tube gauge.

Sebill's water and gas pipes, exhibited by John Gedge & Son, are curious—they are composed of waste slate, vegetable or mineral pitch or rosin, and a small portion of animal or vegetable fibre or bristle. They are cheap, light, and strong, and are easily joined by applying a hot iron to their ends and melting the parts together. This is the first rival to the Bituminised paper pipes which attracted so much attention recently.

Mr Tooth contributes a puddled ball and some excellent specimens of iron, prepared by his rotatory puddler.

Permanent way is largely represented by various contrivances for securing rails, the inventions respectively of Mr E. Gatwood, Thomas Leaville Truss, James Morris, Mr Sayers, and our old friend Mr Thomas Wright, of George Yard, Lombard Street. Our readers are fully acquainted with Mr Wright's system, which has been previously described in our pages.

Mr George Walcott exhibits a model of a patent gas retort bed, whereby a considerable economy of fuel is effected, by passing all the fire from the furnace through and through the materials to be acted upon, until the whole heat is absorbed, and also by feeding the furnace or furnaces with a current or currents of heated air to assist the combustion.

Under the head of Machinery and Manufacturing Appliances, we may mention a simple, but not novel arrangement of sewing machine, wherein the feed motion of the cloth is derived from the needle itself, which vibrates or oscillates laterally at the same time that it works vertically for entering and leaving the cloth. This is exhibited by G. Wright & Co., of Ipswich.

Some capital specimens of Bryant & Cogan's edge laid leather driving straps are supplied by Mr James Ferrabee; these straps offer singular advantages over the old form of straps, and we should think would wear for a very long period.

C. de Bergue & Co. exhibit a workmanlike model of a punching and shearing machine without any slides or guides for the punch, and knives which are attached rigidly to a vibrating lever.

A similar machine is exhibited by Fenn, of Newgate Street, suitable for the bench—the down stroke punches a hole, and the return, or up stroke, accomplishes the shearing operation.

Fuller & Davidson's tube cutter will be found a useful tool for the gasfitter; it is shaped similar to a hand stock for screw cutting; but in lieu of being provided with screw cutting dies, it contains a single cutter adjustable forward as the cut proceeds by a set screw.

James Wood, of West Smithfield, exhibits a papier maché stereotyping apparatus, and some excellent specimens of work in that line, whilst Poulter's composing case and frames is worthy the attention of compositors, as from its peculiar arrangement, the number of boxes is reduced, and the distance to be travelled by the hand in picking up the types is diminished.

Amongst naval and military appliances, etc., we find a model of an "eccentrical propeller," by W. H. Crispin. The blades are perfectly flat, not spiral, and consist of oval-shaped plates secured at an angle to the bars, and eccentric thereto; it is said by the inventor to have more power than the ordinary screw of the same area, and is less liable to be clogged or fouled.

The inimitable Major Rhodes' tent again makes its appearance, this year appealing to the volunteers, in the form of a neat, and we should say, most convenient practice tent. Although, to a certain extent, bell-shaped, yet there is no central pole for the support of the roof, such support being obtained by radial inclined laths or rods, extending from the apex to the eaves, and thence prolonged by vertical supports to the ground. The interior of the tent is thus entirely open, and free from all obstruction.

Mr Calkin's "Occhiombra," or transparent ventilating eye-shade, will be a boon, no doubt, to such railway travellers, or sea-side visitors, as may be endowed with sufficient moral courage to appear in it before a scrutinising British public. It is composed of transparent gauze, mounted on a light wire frame, and so formed as to afford a free escape for the heated air and vapour from the face.

We were much pleased with a simple little contrivance, by J. C. Savery, M.R.C.S., called the hydraulic eye-drop tube. This tube is intended for applying lotions or drops to the eye. It has a portion of its side elastic, so as to be easily compressed by the thumb, and allowed to expand again, so that a drop of fluid may be taken up and expelled into the eye, with the greatest facility, by the most nervous or timid operator.

Messrs Bell, Brothers, of Washington Works, Newcastle-on-Tyne, exhibit some good specimens of aluminium bars, and alloys of aluminium, manufactured by them under Deville's patent.

Mr Jas. Spratt exhibits a lightning conductor and fittings. The conductor point is composed of different metals or alloys, the most fusible being arranged outside, so that the fusing action of an excessive shock of electricity is confined to the outer metal surface or layer, which it melts; and this layer, in melting, becomes an additional conducting power. The metal thus melted destroys the outer point, but discloses the inner point, of less fusible metal, intact. He also exhibits a flat, woven lightning conductor, composed of positive and negative elements, to produce constant electrical excitation in the conductor.

Submarine telegraph cables are exhibited by Mr Josh. Rogers and Mr John Macintosh. Dr Wallich, who accompanied the sounding expedition for the North American telegraph cable, in the "Bull-Dog," exhibits a very simple but effective deep sea sounding apparatus, similar to that used in taking the soundings for the cable referred to.

The stereotrope, or stereoscopic thaumatrope, exhibited by W. T. Shaw, is an amusing toy, but nothing more. It is constructed on the principle of the phantascope, and a great many other long "scopes;" but the image, in place of appearing flat to the eye, is rendered solid by the ordinary stereoscopic effect; whilst the movement of the series of figures before the eye gives the effect of motion in different attitudes to the beholder. In the example referred to, a young gentleman is supposed to be "discoursing most excellent music" on the fiddle! and certainly the combined effects of an apparent solid figure imbued with motion are rather startling; but, on the whole, we prefer the old phantascope.

We noticed some ingenious applications of mica, in the form of painted slides and pictures for magic lanterns, and for exhibiting dissolving views, the groups, figures, etc., being capable of being *printed* upon thin sheets of this substance, which sheets are then protected by being enclosed between sheets of glass, thus enabling designs to be produced much cheaper and more accurately than when hand-painting is necessary. The other example, though it comes under the head of agriculture, etc., may be well noticed here, consists of mica garden labels, the inscription being upon a lamina of mica, which is protected by being placed between two other laminæ of this substance, in which state it will stand any degree of heat, cold, or moisture.

Mr Henry Williamson exhibits a number of silver watch-cases, inlaid with gold. The designs and workmanship reflect great credit upon Mr Williamson, and the rich, but chaste effect produced by the contrast between the inlaid gold and the silver is a novelty in this branch of manufacture, which will, we have no doubt, meet with general approbation.

Amongst the agricultural appliances, etc., we have a model of Braby's machine for breaking up Macadamized roads, to supersede the use of hand labour and picks. It consists of two conical rollers, placed at an angle with each other, and provided with spikes or picks. The whole is mounted on a pair of travelling wheels, and may be drawn to and fro without turning the entire machine, the shafts for the horse being made to turn on a centre pin for that purpose.

J. W. Ashby & Co. exhibit their patent staple beaters and "concave" for thrashing machines. These beaters consist of a series of wrought iron bows or staples, fixed diagonally, in rows, in wrought iron beams round the cylinder or beater. By the use of these beaters the corn is rubbed out, without danger of breaking or injuring the kernel, as the surfaces of the beaters are round and smooth; whilst the hollow under the staple affords space for the free escape of the corn.

Mr White, of Great Missenden, Bucks, exhibits a model of his hay and corn lift, which we previously noticed in our report of the last Smithfield club implement show.

Mr James Anderson, of Farringdon Street, exhibits specimens of what he calls "gravity selected potatoes." He adopts the specific gravity test in selecting potatoes, the best potatoes being those of the greatest specific gravity. The solution employed consists of salt brine, of any desired strength, according to the severity of the test, in which the roots are thrown. The best and soundest will sink to the bottom; the next best will float half-way; and the worst will swim on the surface. This may answer very well in practice for aught we can see to the contrary, indeed a dish of boiled potatoes of a specific gravity of 1·080, which are here exhibited, present a most flattering testimonial to the truth of the system; but, after all, the idea is not a new one, we were made acquainted with it nearly twelve years ago, if we mistake not, by the identical gentleman who now exhibits it.

Amongst building and domestic appliances we noticed a safety chandelier by Mr R. H. Hughes, in which the balance weight is in one circular piece or ring, so that in a breakage of one or even two of the chains accidentally occurring it still remains the same height, the weight simply falling out of position, whilst, in the rather improbable event of the *whole* of the chains breaking simultaneously, the body and weight then descend upon a conical valve, and thereby prevent any accident or escape of gas. An *organ pipe* is placed in the throat of the tube, so that immediately an escape of gas takes place it sounds a shrill whistle, which can be heard all over the house, thereby indicating that more water is required in the tube. What next and next! We certainly remember hearing of that wonderful curiosity in nature the "whistling oyster," but we never before heard of a gas pipe that whistled when it was thirsty.

This is just the season for Mr John Brown's patent cloth padded wood strips for rendering window sashes, &c., air, dust, and water tight. These strips we should say will be found very effectual, and ought to be cheap enough, for they consist simply of pine or oak strips having a strip of cloth or felt imbedded therein at the edges, so as to form a species of cushion or pad. The surfaces to receive these padded strips must be grooved or rebated, so that the strips may lie therein, and this we think is the only objection, because you require the aid of a carpenter to apply the invention; some more simple means might be contrived whereby any ordinary individual may adopt it himself.

Mr F. M. B. Bertram exhibits a very comfortable seat, which he calls the "reception rocking chair;" but strange to say it is devoid of rockers. The rocking motion is derived by bringing the seat to the under frame at each side, and it is controlled by springs concealed in the framework. It is a great advance upon the ordinary American rocking chair.

Messrs Grode & Co., of South Audley Street, exhibit a beautiful specimen of Mojolica work, in the form of a large chimney piece, the produce of the Messrs Minton & Co.

There are some good designs (sadly wanted, alas!) of drinking fountains, both in metal and stone, designed by Mr John Bell; they certainly do him credit, their simplicity and chasteness being highly commendable.

We observed some large glass casks, of a size of about 2 feet in length, by 1·6 inches in diameter, which are stated to be blown in moulds. Their cleanliness will certainly be a recommendation. They are manufactured by Messrs Hubart and Cantillon, of Liège.

Washing and mangling machines are exhibited by Mr Williamson, of Holborn, Thomas Bradford, of Manchester, and Edward Weir, of High Holborn, but in none of them do we recognise anything very striking as regards novelty.

S. & E. Ransome & Co. have a compact little rotatory knife cleaner, consisting of two padded revolving plates between which the knife blade is held. Its smallness and cheapness is its only recommendation, it is only the old story over again.

Under the head of miscellaneous we may mention an improved inkstand, by John Wilkins, it is a very simple contrivance for filling the dipping cup when wanted.

Arnold's machine-made ruffles or frills, exhibited and manufactured by Wight & Co. of Friday Street, will interest, we doubt not, the fairer portion of the community. These ruffles or frills are intended for trimming ladies' and children's garments, &c. They are made entirely in a sewing machine suitably adapted for the purpose. The gathered fabric is drawn up into plaits or gathers, and stitched on to a plain band or fabric at one operation, the same series of stitches serving both to hold the gathers together and unite them to the band. Our readers will find a full description of the mechanism employed for this purpose at page 198, Vol. V., new series, of the *Practical Mechanic's Journal.*

In concluding our notice we wish to draw the attention of the Society to one important point, namely:—the necessity for the attendance and supervision of some qualified officer to see that the models are not too roughly handled. Model making is very costly work, as we know by experience, that a valuable and well made model should not be left to the tender mercies of any big school boy with what is called a "mechanical turn of mind." We noticed several models which had met with most violent treatment; indeed, a very considerable proportion of the working models were either broken or otherwise deranged. Now this might easily be prevented by the precaution above mentioned, and we do think that if the Society professes to open each year an exhibition of models of new inventions, it is at least morally bound to do all in its power to preserve the models entrusted to it from avoidable injury, if not for the exhibitors' sake, at least for that of the public, for whose enlightenment and instruction these exhibitions are supposed to be instituted.

RECENT PATENTS.

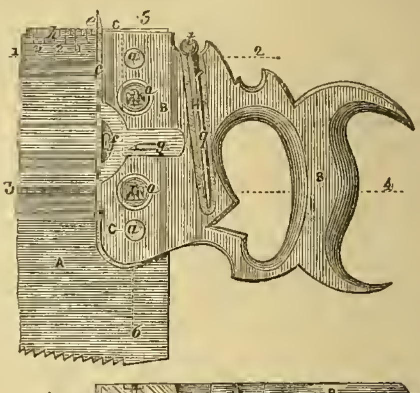
HAND-SAWS.

Henry Disston, *Philadelphia, U.S.—Patent dated July* 9, 1860.

This invention relates to improvements in the combined hand-saw and square, for which letters patent were granted to Mr J. H. Johnson on the 30th Sept., 1857, and consists, firstly, in securing direct to the saw-blade, and adjacent to, but independent of, the handle, certain metallic strips which form the butt or stock of the square, so that the said strips may always remain at right angles to the upper or back edge of the timber and other objects. Secondly, In applying a spirit-level tube or tubes to the handle of a saw in such a manner that the instrument may be used either as a level or plumb-indicator. Thirdly, In attaching the saw-blade to the handle by means of tapered or conical pins, screwed at the ends, and furnished with nuts, so that when, by constant and excessive strains, the blade becomes loosened in the handle, it may be readily tightened up; and lastly, In the application to the handle of a hand-saw of a spring or tongue, situated within an orifice for the reception of a marker, whereby such marker is prevented from being accidentally shaken out of its place.

Fig. 1 of the annexed diagrams is a side view, and fig. 2 a sectional plan (on the line 1 2) of a portion of a hand-saw, illustrating the first, second, and fourth parts of these improvements. Fig. 3 is a sectional plan of another modification, taken, as it were, through the centre of the handle, as on the line 3 4 in fig. 1 and fig. 4 a transverse section on the line 5 6 in both illustrating a modification of the second part of these improvements. Fig. 5 is a transverse section of another modification of this invention, taken as it were, on the line 5-6, in fig. 1, and fig. 6 is a detached portion of the blade, both illustrating the third and fourth parts of these improvements. In reference to figs. 1 and 2, A is a portion of the blade of the saw secured to the handle, B, by the ordinary screws, *a*. To each side of the blade is riveted a metal strip, C, the handle fitting against the inside of the projecting flanges, *c*, of these strips on each side, as shown in fig. 2. The outside of these projecting flanges is situated at right angles to the upper or back edge of the saw-blade, which thus forms the blade of a square, of which the strips or flanges, C, form the butt or head stock. A continuation of the flanges, *c*, projects above this edge of the blade, and is reduced to a sharp edge, so as to form a marker, *e*, fig. 1. From this sharp-edged projection the upper or back edge of the blade is graduated into feet, inches, and fractions of an inch, or other divisions of measurement. By this arrangement there is no danger of the strips, C, moving from their original position, whilst they cannot be affected by any loosening of the handle, inasmuch as the latter is secured to the blade by independent attachments. As the upper edge of the saw-blade is graduated into definite lengths from the extreme end of the blade to the sharpened projection, *e*, the latter will serve the purpose of marking off the distance determined by the blade in measuring long pieces of timber and other objects; and the saw thus arranged will obviate the necessity of a carpenter carrying the ordinary detached rule.

Fig. 1.



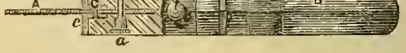


Fig. 2.

The second part of the invention is also illustrated in fig. 1. In one side of the handle, B, two spirit tubes, *f* and *g*, are fitted—these tubes being of the usual construction, and situated at right angles to each other, the tube, *f*, being in a line at right angles to the back edge, *h*, of the saw, and the tube, *g*, parallel with the same. The spirit-tubes are fitted and held in the handle, B, by a metal plate, *d*, forming part of the strips, C, the said plate having apertures at proper points to expose the air-bubble of the tubes to view. Any other suitable means, however, may be employed for securing the tubes in the handle. When the instrument is used as a level, the back edge, *h*, of the saw is placed horizontally on the article to be levelled, the tube, *g*, being the indicator. When it is used as a plumb-indicator, the back edge, *h*, is placed vertically against the side of the article, in which case the tube, *f*, is the indicator. It is obvious that the spirit-tubes may be applied to an ordinary saw as well as to that above described. Another modification of this second portion of this invention is shown in two sections, at right angles to each other, in figs. 3 and 4, and consists in securing the spirit-tube to a circular metal plate, D, having an orifice through which the air-bubble or space in the tube can be seen. This plate bears against one side of the handle, and has a central stem, *m*, screwed at the end for receiving a nut, *i*, which bears against the opposite side of the handle, the whole being so arranged that the plate can be readily turned round. On the edge of the plate are two projections, *j*, situated at such a distance apart from each other, and in such relation to a projecting pin, *k*,

Fig. 3.

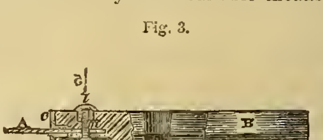
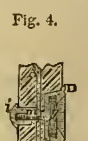


Fig. 4.



on the handle, that when the projection, *j*, is brought to bear against the said pin, *k*, the spirit-tube will occupy a position at right angles to the back edge, *h*, of the saw, and when the plate is turned in the other direction, so that the second projection, *j*, is in contact with the pin, *k*, the spirit-tube is parallel with the back edge of the saw. It will thus be seen that the saw may be used either as a level or a plumb-rule. On reference to the third portion of this invention, represented in cross section and side view of the blade in figs. 5 and 6 respectively, and which relates to the construction of a cheaper class of saws, the shoulder, as at *c* in fig. 1, is formed by the wooden handle on each side of the blade, without the brass flanges, at right angles to the back edge of the saw, so that it may serve the purpose of a square, as in the first modification. The blade, however, is secured to the handle by means of the conical pins, *n*, which pass through tapered holes in the handle and saw-blade, made by a suitable tool, the small ends of the pins being screwed, and furnished with nuts, *p*. By constant use, and excessive strains, the blades of saws are apt to become loose in the handles—an evil which cannot be remedied by the ordinary straight pins or screws used for securing the handle and blade together. By this improvement, however, the conical pins, *n*, and blade can be removed, so as to slightly enlarge the holes in the blade and handle; these being afterwards replaced and the pins screwed up tight, a loose blade may again be firmly secured to the handle. Although this part of my improvements is well adapted to the construction of ordinary hand saws, it is especially applicable to the adjustment of combined hand-saws and squares, when the said blades have become so far out of truth with the shoulder of the handles that the instrument ceases to be of service as a square. Supposing the blade of a combined hand-saw and square, as just described, to have become so far out of truth with the handle that its upper edge has assumed the position shown by the dotted line 7-8, fig. 6, in this case the outer end of the blade will be unduly elevated, and before it can perform with the shoulders of the handle the duty of a square, it must be lowered. The tapered pins are withdrawn, and the blade removed; after which, with a round file and widener, the upper and lower holes of the blade are enlarged, in the direction shown in dotted lines at *x*, to an extent which is deemed sufficient to bring the blade to the square After this the blade is replaced in the handle, the pins re-inserted, and the upper and lower pins driven in to such an extent that they will fit the slightly enlarged holes. Now, in driving these pins, the wood of the handle will yield equally in every direction, the pins taking the direct course of the holes bored in the wood for their reception, so that the act of driving the upper and lower pins will cause the blade to partially turn on the centre pin in the direction of the arrows, the outer end of the blade being thereby lowered, so that its upper edge shall assume its proper position in respect to the shoulders, *c*, of the handle. The same end may be accomplished by allowing the upper orifice of the blade to remain undisturbed, and by filing out the two lower orifices in the same direction as the lowest one, it being filed to a greater extent than the one above it; in fact, it will be readily seen, without further description, that by the use of the tapered pins, and an appropriate enlargement of the orifices of the blade in the proper direction, the upper edge of the blade may be adjusted to the proper position at right angles to the shoulders, no matter in what direction it may have previously become out of truth. The fourth part of this invention is illustrated in fig. 1. In the handle of the saw a hole is bored, into the bottom of which the end of a spring, *q*, is driven; the latter terminates near the top of the orifice, and is bent so as to bear against the steel marker H, which is furnished with a knob, *t*. The spring, *q*, has sufficient rigidity to prevent the marker from falling out from its position in the orifice, during the handling and moving about of the saw, and sufficient elasticity to allow the marker to be withdrawn, when required for use. In using the saw as a square or straight-edge, there is a constant necessity of employing a marker, which being carried with the saw in this instance, obviates the necessity of employing the usual detached marker, the mislaying or loss of which is apt to cause delay and annoyance to the workman.

Fig 5.

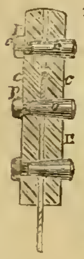
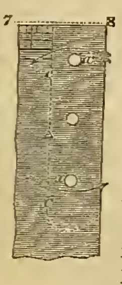


Fig. 6.



MANUFACTURE OF WHITE LEAD.

J. H. Johnson, *London and Glasgow*, (G. H. Ozouf, *Paris*)—*Patent dated July* 19, 1860.

The object of this invention is the production of white lead of superior quality, by means of improved mechanical contrivances. The white lead is produced by the decomposition of basic acetate of lead by means of carbonic acid gas. The inventor accelerates and more perfectly effects the admixture and decomposition by the aid of certain mechanical arrangements, consisting of one or more lift and force pumps worked by a steam engine, or other prime mover, which force into a suitable closed vessel or precipitator, a solution of basic acetate of lead, and a current of carbonic acid gas, produced by the decomposition of a carbonate by an acid, such for example, as carbonate of lime with sulphuric or hydrochloric acid or carbonic acid gas obtained from any other source. By this means the carbonic acid gas and the solution of basic acetate of lead, become intimately mixed, the result of such admixture being the instantaneous production of white lead in the form of a fine precipitate. Any excess of carbonic acid gas existing in the separator passes over into a vessel or gas receiver in connection with the separator, where it is again forced into, or mixed with, the solution of basic acetate of lead

Fig. 1

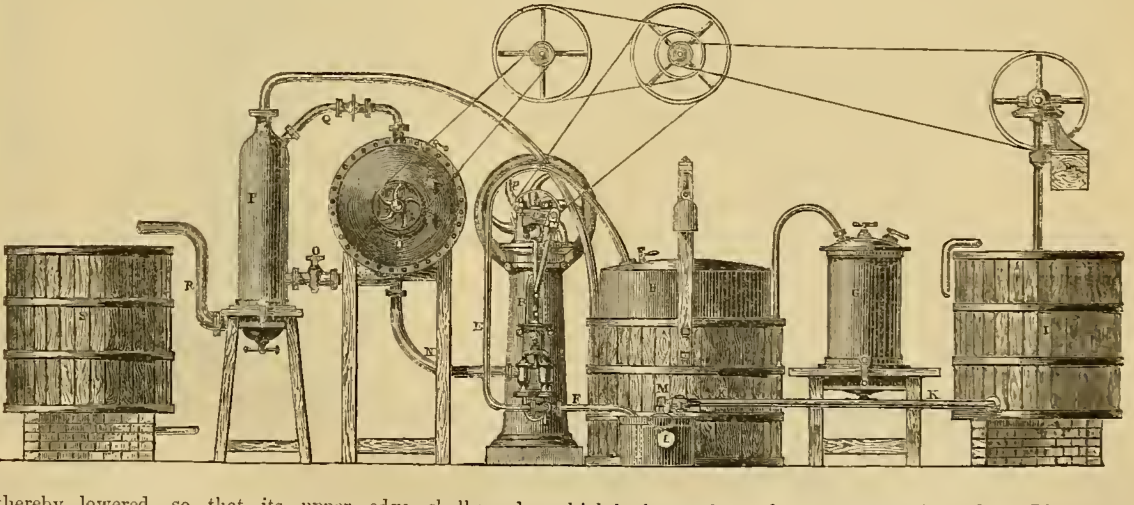
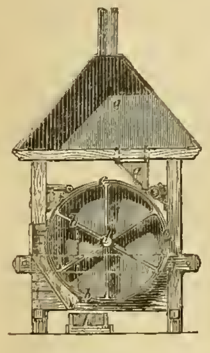


Fig. 1 of the accompanying engravings, represents a side elevation of the combined apparatus complete in working order. One or more pumps, A, are mounted on a support, B, and driven by a belt passed round the pulley fast on the crank shaft, C, which also carries a fly wheel. This fly wheel may be also used as a driving pulley, when desired, the shaft, C, being rotated, actuates through its crank or cranks and connecting rod or rods, the plunger-rod, D, of each pump, A. This pump draws in simultaneously the carbonic acid gas and the solution of the tribasic acetate of lead respectively, through the two suction pipes, E and F, which both open beneath the same suction valve. The carbonic acid gas is produced in the copper vessel, G, in a manner similar to that which is adopted in the production of carbonic acid gas for the manufacture of aerated liquids, but it may obviously be obtained by any other suitable process. The carbonic acid gas passes from the top of the vessel, G, to the gasometer, H, by a bent pipe, and is thence drawn off by the pump, A, through the flexible pipe, E, secured to the top of the gasometer. The solution of tribasic acetate of lead is prepared in the vessel, I, having in it a vertical agitator, which is actuated through a pair of bevel wheels at the top, from a horizontal shaft, J, driven by a large pulley on it, and a belt from any convenient prime mover. A pipe, K, conveys the solution of the tribasic acetate of lead to an intermediate receptacle, L, in which the level of the liquid is maintained at a given height by the float ball cock, M; into this receptacle, L, dips the suction pipe, F, of the pump. The pump, A, having simultaneously drawn in the carbonic acid gas, and the solution of the tribasic acetate of lead, forces them together through the pipe, N, into the closed mixing vessel, L, which is provided with an agitator driven by a band passing round the pulley on its spindle, and actuated by overhead driving shafts and pulleys. This agitator affects the intimate admixture of the carbonic acid gas with the solution of the tribasic acetate of lead, so as to thoroughly saturate the latter, thereby causing the production of white lead in the form of a precipitate, which is held in suspension. On opening the cock, O, the mixture enters the lower portion of the separating vessel, P, whilst the excess of carbonic acid gas ascends and passes into the upper end of the same vessel on opening the cock in the pipe, Q, and finally returns to the gasometer, H, by a bent pipe at the top, while the liquid holding the white lead in suspension flows through the pipe, R, at the bottom into the vessel, S. This vessel or reservoir, S, serves as a distributor of the liquid to various depositing vessels wherein the precipitate is allowed to fall, and whence it is collected in the form of a pure and superior white lead. The mother liquor in the reservoir, S, is returned by pumps or otherwise to the vessel, I, and when mixed with a suitable quantity of litharge, again forms the tribasic acetate of lead, which is to be treated in the manner above described for the further production of white lead therefrom. It will be found advantageous to add occasionally to the liquor a small quantity of acetic acid, in order to compensate for the loss or waste occasioned during the process. The precipitate white lead having been collected, is dried by the apparatus shown in sectional elevation at fig. 2. The white lead, as taken from the depositing vessels, is placed in a hopper, *a*, over a hollow copper cylinder, *b*, provided with a cover, *c*, at each end, and turning on a hollow axis, *d*. This cylinder may be heated either by introducing steam or hot air therein through the hollow axis, *d*, or it may be heated by a number of gas burners arranged in any suitable and convenient manner. The cylinder, *b*, is provided with a fast and loose pulley on one end of its hollow shaft, through which it is driven slowly, and receives a layer of the white lead, which is applied and spread evenly on to the whole length of its surface by the small feed roller, *e*, as fast as it issues from the orifice in the hopper. The thickness of this layer may be regulated by adjusting the roller, *e*, nearer to, or further from, the surface of the drying cylinder by the aid of the set screws. A scraper, *f*, is placed at the opposite side of the cylinder for removing the white lead, which has had sufficient time to become thoroughly dried, between leaving the feed roller and reaching the scraper. A hood and chimney, *g*, carries off the vapour which rises from the drying substance, and the white lead is allowed to fall into small waggons, *h*, or other receptacles placed below to receive it; when it is ready for the market.

Fig. 2.



WINDING MACHINERY.

J. H. Johnson, *London and Glasgow*, (Auguste Provost, *Paris*.)—*Patent dated Feby.* 17, 1860.

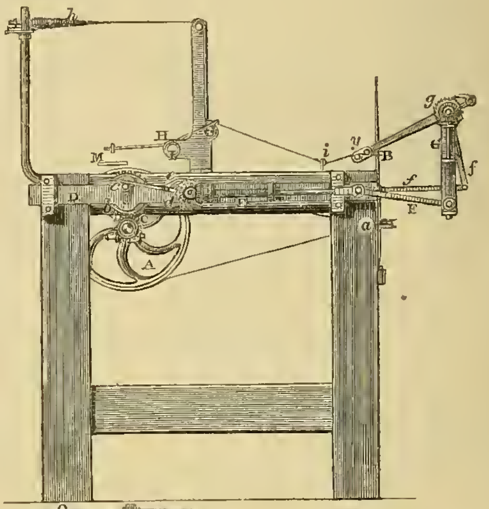
The improvements specified under these letters patent relate to the arrangement and construction of certain improved machinery or apparatus for twisting, doubling, and winding thread.

Fig. 1 represents an end elevation of a winding or doubling frame constructed according to this invention; Fig. 2 is a corresponding plan of the same.

In these figures the main drum, A, drives the spindles, B, through the sheaves, *a*, and it also imparts motion by the pinion, C, to the wheel, *b*, which is provided with a pin, *c*, for obtaining a rising and falling motion through the bar, D; this bar carries two bevel pinions, one of which is actuated by the ratchet wheel, *d*, at each revolution of the pin, *c*, which raises the lever and pall, *e*. The other pinion is traversed by a screw spindle, E, connected with a rod, F, which is attached to the bell crank, G, producing the progressive ascending movement of the thread. This bell crank oscillates on a centre, and one of its arms carries the two parallel rods, *y*, which serve as stretchers for the threads to be spooled or doubled. In order to obtain the desired shape at the lower portion of the spool or cop, the second arm of the bell crank carries a screw spindle worked by bevel pinions actuated by the bar, D, by the aid of small jointed levers, *f*, and pall, which gears into the teeth of the ratchet wheel, *g*.

The threads to be doubled and wound are conducted from the spindles or pirns, *h*, at the back of the machine through the rings or guide eyes of electric oscillating levers, H, and thence through the guide eyes, *i*, where they are united and doubled in order to be wound on to the spindles, B. Should a thread become broken a stoppage of the action of the machine is effected by any one of the levers, H. For this purpose the small counterweight (variable at will), and placed on the extremity of the lever, H, causes that lever to incline or turn over so soon as it is abandoned by the thread. The counterweight is thereby brought in contact with a metal plate, M, in communication with an electro-magnet capable of raising the catch, N, whereupon the strap guide, O, being released is slid by a counterweight, so as to bring the driving strap from the fixed pully, P, to the loose pulley, thus effecting the stoppage of the machine. The electro-magnet may also be made to agitate a bell, which will call the attention of the attendant to the machine. The axis, I, which supports the levers, H, is in communication with the positive pole and the metal plate, M, with the negative pole of the battery.

Fig. 1.



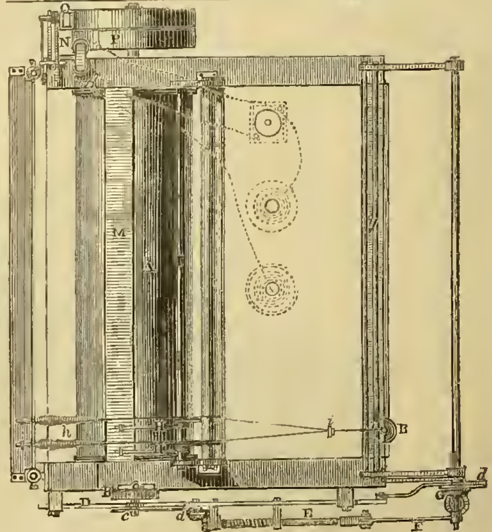


Fig. 2.

The contact of any one of the levers, H, with the plate, M, consequently establishes the electric circuit, and the magnet coming into action effects the shifting of the driving strap and stoppage of the machine.

Another mode of working the sliding bar, D, which gives the progressive advance and vertical motion required in forming the cop. The shaft of the drum, A, carries a pinion which drives a spur wheel, the axis of which carries a small tooth segment in gear alternately with the upper and lower racks in the bar, D. By these means the rising and falling of the thread is effected. A pall attached to the framing actuates at each stroke of the bar, D, a ratchet wheel which, by the aid of bevel wheels, drives the screw spindle, E, connected with a rod, F, attached to the bell crank, G.

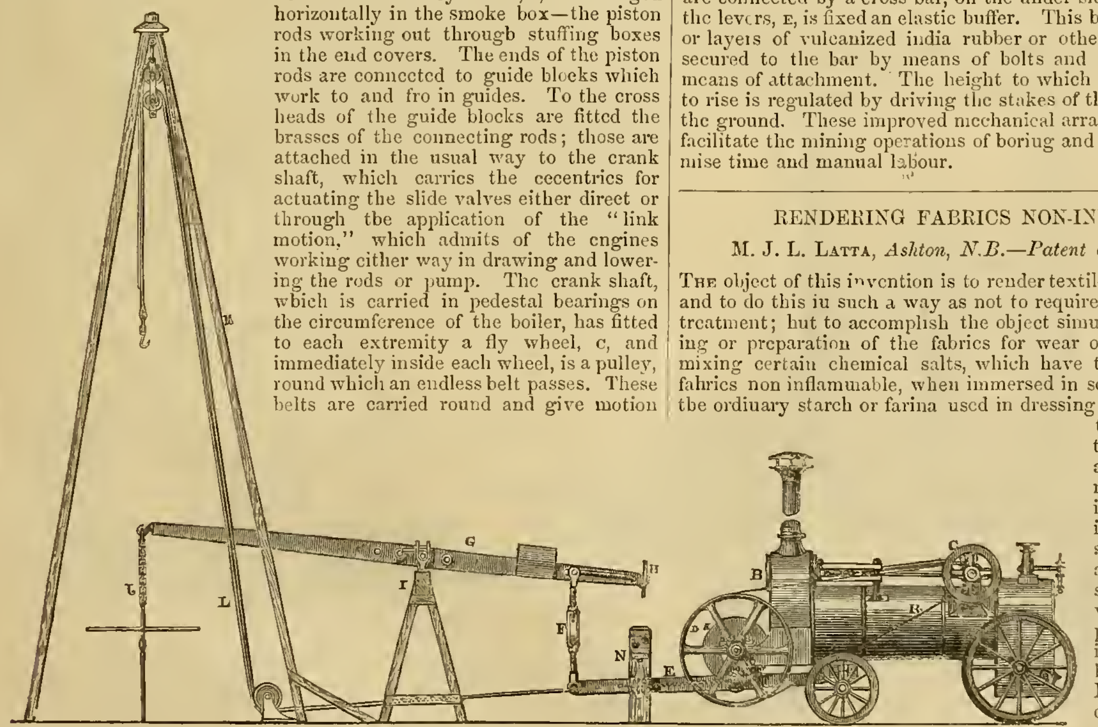
In order to facilitate the formation of the lower conical part of the cop, and to assist the winding on, it is proposed to place a cone of hard india-rubber, gutta percha, or other suitable material below the metal cop tube. The cops produced by the machines above described are similar to the mule cop; they are removed from the machine and placed in the twisting and winding machine. This machine serves to twist the threads and wind them in the form of hanks or skeins, or in other forms, as required. The spindles being driven at a high velocity twist the threads which are passed through openings in a notched plate fitted on the front of the machine On leaving this plate the threads pass over a roller, and thence through the guide eyes in the ends of the oscillating electric levers, whence they proceed direct round the winder, which is driven at a slow speed. In this machine, as in those previously described, each of the levers establishes a circuit for the electric current, when any one of the threads become broken, thereby sounding the bell and stopping the machine.

A compound machine is also included in these letters patent, and this machine contains two drums; the first one drives the cop spindles, which are mounted horizontally, and are driven at a high velocity, thereby imparting a twist to the threads as they are drawn off the cops, and the second drum drives the spindles and flyers. The threads proceeding from the cops are conducted through and over the guides and rollers, where they are doubled, they then pass through the eyes of the oscillating levers, and between the rollers, which deliver them to the spindles of the twister. The use of metallic bushes or cop tubes obtained by the electrotype process, or other simple means, is of great advantage when the cops have to be frequently transferred from one set of spindles to another, whilst a considerable saving is effected, inasmuch as the thread can be wound off to the bottom without any waste.

BORING AND WINDING MACHINERY.

James Hunter, *Coltness—Patent, dated August*, 4, 1860.

Mr Hunter's improvements comprehend a simple arrangement of machinery for actuating boring and winding apparatus. The subjoined engraving represents an elevation of one arrangement of the machinery. According to this modification of the improvements, the boring and winding apparatus is actuated by means of a portable engine, A, which is mounted upon wheels, and is moved from place to place by attaching horses to it. The cylinders, B, are arranged horizontally in the smoke box—the piston rods working out through stuffing boxes in the end covers. The ends of the piston rods are connected to guide blocks which work to and fro in guides. To the cross heads of the guide blocks are fitted the brasses of the connecting rods; those are attached in the usual way to the crank shaft, which carries the eccentrics for actuating the slide valves either direct or through the application of the "link motion," which admits of the engines working either way in drawing and lowering the rods or pump. The crank shaft, which is carried in pedestal bearings on the circumference of the boiler, has fitted to each extremity a fly wheel, C, and immediately inside each wheel, is a pulley, round which an endless belt passes. These belts are carried round and give motion to the wheels, D, on the front horizontal shaft. This shaft is carried in hearings which are arranged in brackets, projecting from the front part of the engine. In the centre of the front shaft is fitted a snail cam, the rotatory motion of which imparts a reciprocatory movement to a pair of levers, E. These levers are arranged parallel to one another, and practically form one; they are centred upon a stud which is carried in brackets pendent from the under part of the boiler—and between the levers is fitted an antifriction roller with which the snail, J, comes in contact, as it rotates. The free ends of the levers, E, are connected by a pin to the lower end of the adjustable link, F, the levers having holes made in them to admit of the levers being shortened by connecting the levers to the inner holes The upper end of the link, F, is connected to a screw which works out through a nut in the end of the lever, G, and is actuated by the hand wheel, H, by means of which the link may be moved to and fro in the slot of the lever, G. This lever has formed in it a series of holes, through one of which is passed a horizontal shaft, which is carried in bearings arranged on the framing, I. The holes in the lever, G, afford the means of shifting the centre of the lever and so increasing or decreasing the longer or working portion of it. The end of the lever, G, carries a hook, to which is slung the chain, J, attached to the cross handle, carrying the boring rods and boring tool. The lever, G, also carries a box or other suitable receptacle for holding a weight to counterbalance the weight of the boring rods. The box is adjustable along the lever, G, so that its position on the lever may more or less adjust the rise of the boring rods. When the engine is put in motion the rotatory action of the snail causes the levers, E, to reciprocate in a vertical plane, and this motion is imparted to the link, F, and through it, in an increased degree, consequent upon the compound arrangement of the levers to the lever, G. The shortening or lengthening of the levers, E or G, and link F, admitting of a considerable range of motion being imparted to the end of the lever, G, and through it to the boring rods. In this manner an extremely gentle rise and fall may be given to the boring rods, and this may be increased to any practicable extent. On the front horizontal shaft are carried loosely two winding barrels or drums, K, either of which may be caused to rotate with the shaft at pleasure by means of a coupling which is actuated by a hand lever. Upon these drums, K, are wound the ropes, L, one of which serves to raise the boring rods, and the other for lowering and raising the pump. The ropes or chains are carried over pulleys, which are supported by the ordinary tripod frame, M, erected over the boring. By means of the hand lever, either of the winding barrels or drums, K, may be brought into use, and the lever, G, may be meanwhile thrown out of use either by detaching it from the levers, E, or by causing the box or counterweight to preponderate and so depress the backward end of the lever, G. To prevent the levers, E, from rising too high, the buffer, N, is fitted at the fore end of the levers; this arrangement consists of two stakes or pillars driven into the ground; these stakes are connected by a cross bar, on the under side of which, in a line with the levers, E, is fixed an elastic buffer. This buffer is composed of sheets or layers of vulcanized india rubber or other suitable elastic material secured to the bar by means of bolts and nuts or other convenient means of attachment. The height to which the levers, E, are allowed to rise is regulated by driving the stakes of the buffer more or less into the ground. These improved mechanical arrangements serve to greatly facilitate the mining operations of boring and winding, as well as economise time and manual labour.



RENDERING FABRICS NON-INFLAMMABLE.

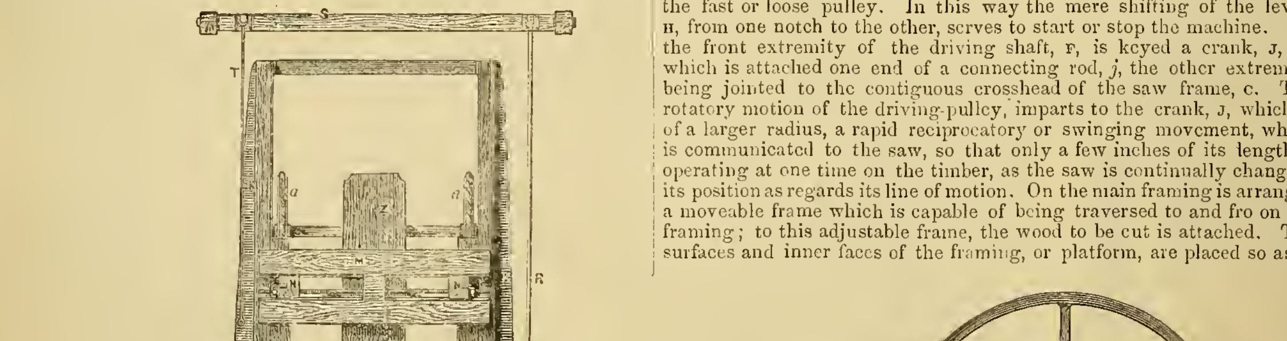
M. J. L. Latta, *Ashton, N.B.—Patent dated June* 27, 1860.

The object of this invention is to render textile fabrics non-inflammable, and to do this in such a way as not to require any special and distinct treatment; but to accomplish the object simultaneously with the dressing or preparation of the fabrics for wear or sale. This is done by mixing certain chemical salts, which have the property of rendering fabrics non inflammable, when immersed in solutions of the same, with the ordinary starch or farina used in dressing fabrics to impart stiffness thereto. Or solutions of the said salts may be used alone for the purpose of rendering fabrics non-inflammable where starch is not required. Certain salts of soda, potash, alumina, and zinc are suitable for the purpose, which salts are used by preference, in the following proportions and combinations: — Preparation No. 1 consists of one part of bi-borate of soda, one part of chloride or muriate of ammonia, and one part of starch or farina. These several ingredients are mixed together, and this is, by preference, to be done by the starch manufacturer, and the preparation sold to the public in the same way as ordinary starch. Preparation No. 2 consists of one part of sulphate of magnesia, two parts of chloride or muriate of ammonia, and one part of starch mixed together. Preparation No. 3 consists of three parts of chloride of ammonia mixed with one part of starch or farina. Preference is given to the foregoing preparations for rendering fabrics non-inflammable, but the same object may also be accomplished by means of the following combinations of salts with starch:—No. 1 preparation of the second series, consists of one part of sulphate of zinc, one part of chloride of ammonia, and one part of starch mixed. No. 2 consists of equal proportions of sulphate of zinc and starch mixed together. No. 3 consists of one part of sulphate of potash, one part of the chloride of ammonia, and one part of starch mixed. No. 4 is composed of three parts of carbonate of soda, mixed with one of starch. In manufacturing these preparations of starch for public use, a small quantity of stearine or prepared wax may be advantageously added to the mixtures; this addition may be in the proportion of 56 lbs. of stearine or wax may be added to one ton of starch. The addition of the stearine or wax facilitates the ironing of the fabrics after being starched. Instead of putting up the starch, prepared according to these improvements, in a powdered or solid form, the preparations, where desirable, may be manufactured and sold in the liquid state. Or the combinations of the chemical salts hereinbefore named may be used without the addition of starch, for the purpose of rendering textile fabrics non-inflammable. The fabrics, articles of dress, window or bed curtains, or other drapery are immersed in the starch or other stiffening material, which is prepared in the usual way; neither is any deviation made from the ordinary mode of starching or dressing the articles to be rendered non-inflammable. Textile fabrics, when treated in this manner, are rendered non inflammable, that is to say, they will not flame when exposed to fire. By this means the many accidents which occur to life and property from the inflammable nature of textile fabrics, particularly when hanging in loose folds, may be avoided, and without incurring either extra expense or trouble.

VENEER CUTTING MACHINE.

JOHN FERGUSON, *Glasgow*, (J. F. C. WIELAND, *Hamburg.*)—*Patent dated July*, 12, 1860.

THIS invention relates to the arrangement and construction of veneer or plank-cutting machinery, by means of which a greater number of veneers can be cut per inch, than with the machinery at present in use, at the same time the work is done in a superior manner.



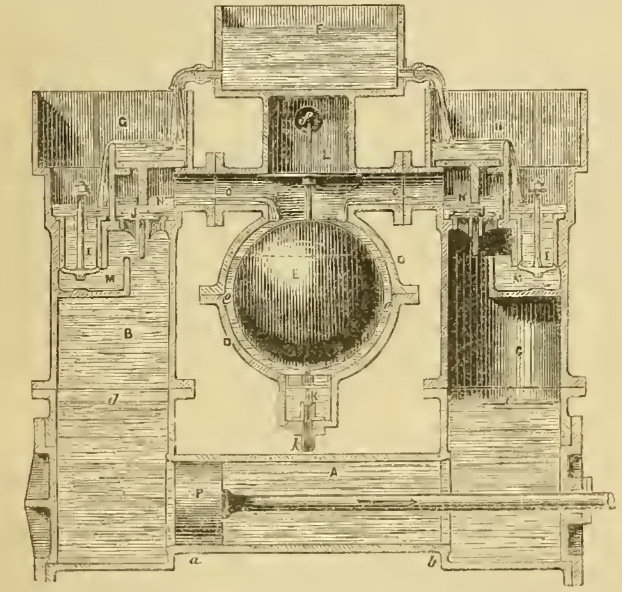
The accompanying engraving is an elevation of the veneer and plank-cutting machine. The connection between the saw frame and the driving-end of the machine is broken in order to save space. The framing of the machine consists of a pair of comparatively low end standards, by preference formed of cast-iron. On the front part of this framing is arranged a cross beam, A, the ends of which project out beyond the framing, and are curved slightly in an upward direction. On these outwardly projecting parts are fitted two pairs of brass guides, B. Extending across the machine, between these guides, is the saw frame, C, which consists of a longitudinal wooden bar having a cross-head at each end, in which are fitted the slides that work to and fro in the guides, B. The front ends of the crossheads are braced together by a tension rod, and the saw, D, is stretched between the inner ends of the crossheads; the tightening up of the tension-rod by means of the nut on its extremity, serves to stretch the saw, and give it the necessary degree of tightness. The saw, D, is formed of a long and comparatively deep blade of steel, with the teeth directed downwards; this saw is guided and kept in a right line by means of the guide or knife, E, which is arranged immediately in front of the saw. The guide, E, is formed of a wedge-shaped figure, the apex of which is directed downwards, and terminates immediately above the teeth of the saw. It is carried in two vertical bracket-pieces, which are bolted to the front cross piece, A, of the framing. The face of the guide or knife, E, next the saw, D, is made slightly convex, to insure the continuous contact of the saw. As the veneer cutting operation proceeds, the veneer passes up on the outer face of the guide, E, and as it passes out over the guide, it is attached by a clasp to the top of the slab of wood from which it is taken, until the cut is completed; the veneer is then removed, and the slab is lowered by hand for a fresh cut. The upwardly sweeping curvature of the guides, B, causes the saw, when put in motion, to move in a curved path, or with a sort of swinging movement, similar to the movement imparted to a double-handed saw when operated by hand. This kind of movement is very effective in preventing the saw from sticking, or becoming clogged during the cutting of the log. On a sole plate, arranged on a suitable base near the saw-frame, are fitted the pedestal bearings of the driving-shaft, F. This shaft carries at the centre, a fast and loose pulley, and at one extremity a fly-wheel. An endless belt carried from a shaft overhead, or arranged in convenient proximity thereto, gives motion to the driving pulley. The belt is shifted at pleasure from the fast to the loose pulley, and *vice versa*, by means of the fork, G, which is attached to a sliding-piece, moving to and fro on a standard at the end of the sole plate. The sliding-piece is connected by a link to a long hand lever, H, which is centred on a stud carried in a standard near the front end of the sole plate. The hand lever, H, extends in a lateral direction towards the saw-frame, so as to be within convenient reach of the machine attendant, that he may be enabled to start or stop the machine instantly when required. The hand lever, H, is held during the running or stopping of the machine in the crosshead, I, which has two notches or recesses formed in it to receive the lever and hold it while the belt is either on the fast or loose pulley. In this way the mere shifting of the lever, H, from one notch to the other, serves to start or stop the machine. On the front extremity of the driving shaft, F, is keyed a crank, J, to which is attached one end of a connecting rod, *j*, the other extremity being jointed to the contiguous crosshead of the saw frame, C. The rotatory motion of the driving-pulley, imparts to the crank, J, which is of a larger radius, a rapid reciprocatory or swinging movement, which is communicated to the saw, so that only a few inches of its length is operating at one time on the timber, as the saw is continually changing its position as regards its line of motion. On the main framing is arranged a moveable frame which is capable of being traversed to and fro on the framing; to this adjustable frame, the wood to be cut is attached. The surfaces and inner faces of the framing, or platform, are placed so as to form guides for the rectangular base frame of the standards, K, which are formed with backwardly-extending stays near the base, and are connected by a cross rail at the upper ends. To the faces of the standards, K, are fixed the vertical wooden guides, between which the frame, L, moves up and down; the longitudinal side pieces of this frame are each fitted with a metal plate or feather, the projecting part of which works in the grooves of the guides. The wood carrying-frame, L. is by preference, about twelve feet long, and extends downwards consi derably below the base of the machine, into a pit or recess formed beneath. At the upper and lower ends of the frame, L, is fixed a guide, M, in which is arranged the clamps, N, which move to and fro on a screwed spindle, and are adjustable thereon by means of the nuts. The log or slab of wood to be cut into veneers, is glued to an open or lattice frame to admit of its being completely cut up into veneers. This open frame carrying the log is placed between the clamps, N, which are then screwed up tightly, so as to hold the frame securely, and if necessary, the frame is further secured by means of screws passing through the guides, M, and into the open frame. At the commencement of the cutting, the frame carrying the log is lowered down, so that the edge of the upper end of the log is brought under the saw, D; the saw is then put in motion, and the frame is traversed upwards as the veneer or plank is cut. This upward traversing movement is obtained from the driving shaft, F, on the backward extremity of which is a cone pulley, the endless cord from which passes round a cone pulley, O, the spindle of which is carried by a bracket projecting out from the framing, and carries on its backward extremity, a bevel pinion which gears with a corresponding pinion fast to the small vertical spindle, P. This spindle has a worm formed on it, (which gives motion to the worm-wheel, U), which is carried in a moveable bracket-piece, Q, the lower part of which is prolonged in a lateral direction, so that it forms a bell crank lever. This lever, Q, is moveable about a stud fixed in a bracket, the stud being arranged exactly in a line with the spindle of the pulley, O. The free extremity of the bell crank lever, Q, is connected to the rod, R, a projecting part of the bracket, serving as a guide to check the traverse of the lever in the vertical direction. The rod, R, is carried up to an arm which projects in a lateral direction from the rocking shaft, S, the bearings which are arranged in any convenient manner overhead. Near the other end of the shaft, S, is a laterally projecting arm, to which the rod, T, is attached. When the machine attendant draws this rod, T, down, and hooks it on to a hook near its lower extremity, it draws up the rod, R, and tilts the bell crank lever, Q, so that the worm is thrown out of gear with the wormwheel on the spindle, V, and the motion of this part of the machine is instantly stopped. Thus, if the cutting of the veneer is at any time unsatisfactory, the simple hooking on of the rod, T, to the hook instantly stops the upward motion of the log, and the cutting is arrested. The worm on the spindle, P, gives motion to the worm-wheel, U, which is fast to the shaft, V. The front extremity of the shaft, V, is fitted with a winch handle, to enable the machine attendant to operate the shaft by hand. On the shaft, V, is carried loosely the pinion, W, which gears with the spur wheel, X, the bearings of which are arranged upon a cross stay of the standards, K. The wheel, X, and pinion, W, are kept in gear by means of the bracket, Y, which encircles the boss of the pinion, W, and is made fast thereto, the pinion having a feather inside the boss, which feather slides to and fro in the groove formed in the shaft, V. Thus as the base frame is moved to and fro, the pinion, W, traverses with it on the shaft, V. The short shaft to which the wheel, X, is keyed, carries at its front extremity, the pinion which is in gear with a rack on the back of the central piece of timber, Z, which forms a portion of the traversing frame, L. Thus when the shaft, V, is put in motion, say by the worm-wheel, U, the frame, L, and the log to be cut, is moved upwards at a uniform speed suited to the cut of the saw. When the log has ascended and the veneer cut completely off, the machine attendant can cause the frame and log to descend quickly, by simply drawing down the rod, T, which throws the worm out of gear, and turning the handle on the shaft, V, in the direction to cause the descent of the frame, L. To admit of the easy vertical traverse of the frame and log, it is counterbalanced, so as to hang nearly in equilibrium. Cords or chains are attached to the bottom of the frame, L, and are carried over the pulleys, *a*, which are carried on a transverse shaft, arranged between the standards, K. To the other extremities of the cords is attached a box, in which is placed the weights for counterbalancing the frame and log. In front of the machine is fitted an arrangement for causing the log of wood to be brought forward a pre determined distance, so as to cut it into veneers of uniform thickness. The beam, A, has cast on it, or bolted thereto, a pendant bracket through which a screwed spindle passes, and which also carries a quadrant. The margin of this quadrant is graduated, and it has fitted to it a moveable gauge, which may be fixed at any part of the quadrant by a pinching screw. The screwed spindle passes through a deep bush, which is fast to a cross-stay, *b*, forming a part of the traversing frame, so that when the screw is turned round, it causes the frame to advance or recede. To the front part of the screwed spindle is attached the disc, *c*, which is fast thereto, and on the extremity of the spindle is fitted loosely the hand lever, *d*. By means of a pinching screw, the hand lever, *d*, may be made fast to the disc, *c*, so that the motion of the hand lever will then cause the screwed spindle to turn in the bush on the cross stay, *b*. The divisions on the graduated quadrant, indicate aliquot parts of an inch, so that when the gauge is fixed opposite a given number, the log will be cut into veneers of a corresponding number to the inch If, for example, the edge of the gauge is placed opposite the number sixteen on the quadrant, the log will be brought forward the sixteenth of an inch after each cut. When the gauge is adjusted to the required number of veneers, the hand lever, *d*, is moved round in a backward direction until it comes in contact with the pin or stop, *e*; the pinching screw in the lever, *d*, is then screwed up so as to connect the lever, *d*, to the disc, *c*. The hand lever and disc are now moved forward until the lever is stopped by the pin projecting from the gauge. As the disc, *c*, is fast to the screw, the cross stay, *b*, and frame, will consequently have been brought forward a distance corresponding to the partial rotation of the screw, the pitch of which is so regulated as to agree with the divisions marked on the graduated quadrant. In this way, as each cut is effected, the machine attendant loosens the pinching screw and moves the hand lever, *d*, back to the pin, *c*, the screw is then tightened, the disc, *c*, is again brought round, and another cut is made. During the cutting, the moveable frame is tightened by means of wedge pieces, which are actuated by the hand levers, *f*. After adjusting the screw, the workman draws the levers, *f*, inwards, which tightens up the frame carrying the log. When the veneer is cut, the levers, *f*, are pushed back and the screw re-adjusted. As a further security to insure the steadiness of the log during the cutting, a rectangular block of wood is fixed to the cross-beam, A; this block is of about the length and breadth of the knife or guide, H, and it presses against the log immediately under the saw during the cutting, so as to keep it perfectly steady, and prevent vibration. This pressing block may be formed with grooves in its face, to receive wedges of hard wood which press up against the log, and these wedges may be tightened to any required degree. In lieu of this arrangement, the block may be secured by screws, or other adjustable means, to the upper surface of the cross beam, A, and so arranged that it may be readily moved to and fro. In cutting planks with this machine, the knife or guide, E, is removed, as well as the pressing block just referred to, and in place of the guide, E, two guides, which press against the face of the saw, are bolted to the beam, A. These guides are by preference bolted to the beam just beyond the brackets which support the guide, E The outer portion of each guide is in the form of a rectangular block of metal, which is adjustable, and presses against the saw to keep it in a right line during the cutting. It is preferred to have several saws with their frames, so that when the one in use becomes blunt, it may be removed and another placed in the machine. This is done very quickly by removing the wooden pin which passes through the staple at the end of the connecting rod, *j*, and to prevent the rod from falling to the ground, or otherwise doing injury, it is linked to the guide, *g*. In this way the machine attendant has within his immediate reach the several means for starting, stopping, or disconnecting the saw, and for throwing the timber carrying frame into or out of gear, without moving from his place in front of the machine.

COMPRESSING ELASTIC FLUIDS.

J. H. Johnson, *London and Glasgow*, (G. Sommeiller, *Turin*.)—*Patent dated April* 9, 1860.

The improvements specified under these letters patent, consist of a peculiar arrangement and construction of apparatus for compressing air, gases, and other elastic fluids, and consists in the employment of a horizontal cylinder, opening at both ends into two vertical cylinders respectively. A piston is caused to work to and fro, by any prime mover, along the horizontal cylinder. This last mentioned cylinder is filled with water, which partially fills the vertical cylinders also, the piston is thus entirely enclosed by water on both sides. The two vertical cylinders are each provided with a pair of valves kept hermetically air-tight by hydraulic joints, the valves and valve seats being surrounded by water. One of each pair of valves serves as the inlet for the air or gas to be compressed, and the other allows the compressed air or gas to escape into a pipe leading to the compressed air or gas reservoir. The to-and-fro motion of the piston in the horizontal cylinder causes a simultaneous elevation of the water level in the one vertical cylinder, and a corresponding depression of the water level in the other cylinder. As the water level descends, the external air (if it is sought simply to compress atmospheric air), enters the cylinder by the inlet valve at the same time a small quantity of the water which surrounds that valve escapes into the cylinder with the air, and at the next stroke of the piston, the raising of the water level compresses the air above the water in the cylinder, and forces it through the outlet valve into the pipe leading to the reservoir or air-vessel, a small escape of water again taking place with the air out of the cylinder.

The annexed engraving represents a longitudinal vertical section of the improved apparatus in working order. A, is the horizontal cylinder, within which works to and fro the piston, P, actuated by any convenient prime mover. This cylinder opens at both ends into the compressing cylinders, B and C, respectively; L, is a horizontal cylindrical reservoir, in which is placed a cylindrical float, R, a free space, *e*. being left between the exterior of the float and the interior of the reservoir, D. F, is a water reservoir or tank, which is kept constantly supplied from any natural or other convenient source, and is provided with two cocks, which direct the water into the two vessels, O and H, respectively; I,



are two inlet valves for the entrance of the air or gas to be compressed into the compressing cylinders; J, are two other valves, which admit of the exit of the compressed air or gas from the compressing cylinders respectively; and K, is another valve fitted into the bottom of the reservoir, D, and connected with the float, E, for the purpose of effecting the periodical emptying of the reservoir. L and O, are two horizontal tubes or passages, the one serving to conduct the compressed air or gas to any suitable accumulating reservoir, which is not represented in the drawing, and the other serves to carry off the water which is operated in the compression of the fluid. The piston works to and fro in the water, which always maintains an air-tight joint, and the tightness of the valve, I and J, is also maintained perfect by keeping them constantly immersed in water by the aid of the respective vessels or small reservoirs, M and N, which are always maintained full of water at a constant and invariable level, which water effectually prevents the return of the air or gas, whether at the inlet or exit valves. The compressed air or gas in the cylinders or compressing chambers, B and C, passes out by the valves, J, simultaneously with a small quantity of water, which is carried along with it mechanically, and expands in the space, O, whence it passes by the passage, L, into the receiver or magazine. The small quantity of water which is carried over by the air into the space, O, serves to keep the vessels, N, csnstantly supplied, the surplus water flowing off into the reservoir, D. When this waste water has attained a certain level in the reservoir, it elevates the float, E, which draws with it and opens the emptying valve, K, through which the water escapes, and under the pressure of the air or gas in the space, O, above. The escape of the water causes the float, E, to descend again, and so close the valve, K, until the further supply of water again elevates the float and valve. Thus the water supplied by the cocks in two continuous jets, after having fulfilled its purpose of packing or keeping air-tight the inlet valves, is expelled intermittently and automatically from the apparatus at the same time with the water carried along by the compressed air. Although the constant admission of fresh cold water into the apparatus might be objected to as tending to a certain extent to diminish its useful effect, yet this entrance of cold water acts beneficially in other respects by keeping down the temperature of the apparatus, as it will absorb the heat generated by the compression of the air or gas. Supposing the apparatus to be started, the piston, P, will travel in the direction of the arrow from *a* to *b*, and the outlet valve, J, of the compressing cylinder or chamber, B, closes. This cylinder, B, is completely filled with water, whilst in the cylinder, C, the water reaches only to the level, *c*, the remaining part of this second cylinder is filled with air or gas, as the case may be. Now, during the course the piston travels, from *a* to *b*, the level, *c*, will rise and compress the air above it until it forces open the other outlet valve, J, and escapes into the space, O, and thence by the tube in the chamber, L, to the receiver. On the arrival of the piston at *b*, or the end of its stroke, the valve, J, closes again, and it is kept tight by the presence of the water which covers it in the vessel, N. Should this valve be imperfectly made, a leakage or back flow will take place through it, during the return stroke of the piston from *b* to *a*, but this leakage will only be a small quantity of water, and not of the compressed fluid enclosed in the space, O. Whilst the piston has been travelling from *a* to *b*, the inlet valve, I, of the cylinder or chamber, C, has of course remained closed and been kept air-tight by the water in the vessel, M, in which this valve is immersed. So also with reference to the other valve, J, any leakage through this valve, I, will merely result in the escape of a small quantity of water, whilst the compressed fluid itself is retained in the cylinder. The operation of the cylinder, B, during the return stroke of the piston from *b* to *a*, is precisely similar to that already described in reference to the cylinder, C, but it has in the meantime been filled with air or gas through the inlet valve, I, and its water level has descended to the line, *d*, so that when the piston begins to move from *b* to *a*, the air or gas above it will be compressed and forced out eventually through the outlet valve, J, into the space, O, and receiver. Whilst this is taking place, the level of the water in C, is descending, and a fresh supply of air or gas is entering by the inlet valve, I. The volume of air which enters and is expelled from each cylinder, B C, alternately, is of course equal to the volume of water dispelled at each stroke of the piston.

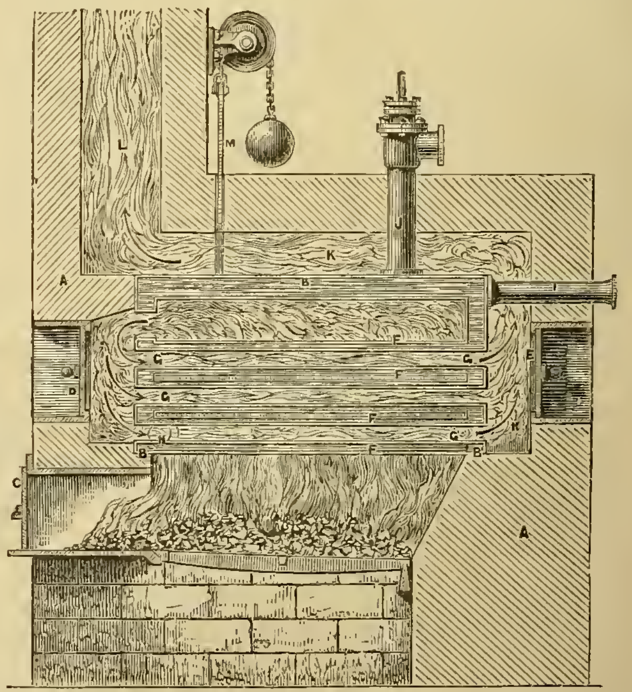
BOILERS.

John Trayes, *Belfast.—Patent dated May* 29, 1860.

The improvements specified under these letters patent relate to the arrangement and construction of steam-boilers, or heat and steam generators, in such a manner as to obtain a very large amount of heating surface within a very small space, whilst the heat is applied in a peculiarly effective way.

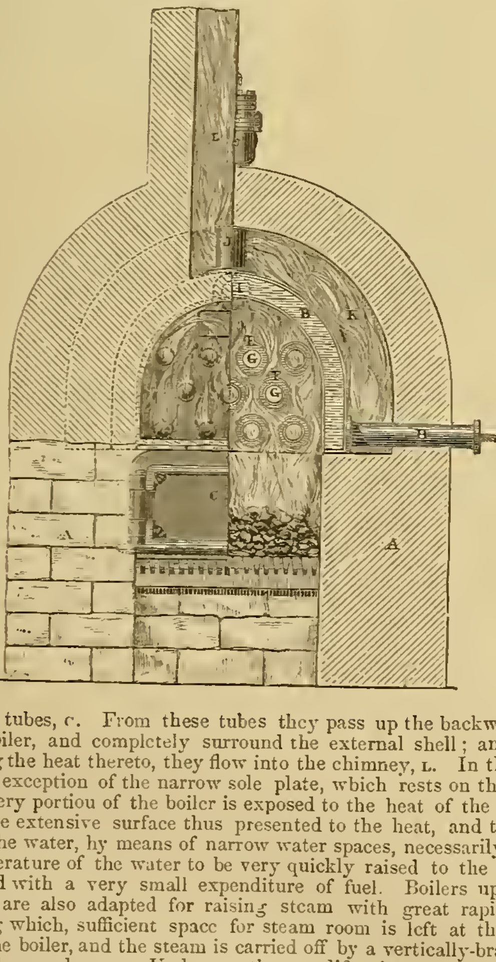
Fig. 1 of the accompanying engravings is a partially sectional elevation of one arrangement of the improved boiler as adapted more particularly for the application of heat. Fig. 2 is a sectional elevation of the arrangement, taken at right angles to fig. 1. The brickwork, A, in which the boiler is incased, forms at the lower part a rectangular recess, in which the furnace is arranged. The brickwork is carried up vertically above the furnace bars, and then extends out laterally on each side, forming a longitudinal semicircular recess, which is inclosed by the outer casing of brickwork. In this recess the boiler, B, is arranged. In the example given, the main portion of the boiler is of a semicircular or horse-shoe-shaped figure, the lower part of which rests upon the sole of the arched part of the brickwork. The front part of the furnace is inclosed by a door, C, in the ordinary way; and above this an opening is formed in the brickwork, which gives access to the front end of the boiler, for the purpose of cleaning the tubes. This aperture is closed by the door, D; a corresponding opening is formed in the brickwork at the opposite end of the boiler, which affords access to the tubes of the boiler, and to the flue or space surrounding it; this opening is closed by the door, E. The boiler is formed of an external and internal shell of boiler plates, which are curved to the horse shoe figure, and arranged

Fig. 1.



parallel to each other, so as to leave a comparatively thin water-space between the inner and outer shells. The ends of the boiler are flat, and form vertical water spaces, corresponding to the arched portion. Extending longitudinally to each of the inner end plates is a series of tubes, F; and arranged within each of these tubes is an internal tube, G, which is attached to the outer end plates, or external shell of the boiler. With this arrangement it follows that the water within the boiler flows along the thin water space formed between the tubes, F and G, and thus completely surrounds the inner tubes. Water is supplied to the boiler from the inlet pipe, H, which is connected with any suitable and convenient source of supply. The heated water flows off by the pipe, I, which, when the boiler is arranged for heating purposes, is connected to the pipes that are carried through the building. The boiler is fitted with a safety valve in the pipe, J, and the flue, K, leading to the chimney, L, is provided with a damper, M, for checking the draft when required. The flame and heated gaseous products of combustion arising from the furnace pass up between the tubes, F, and, on reaching the crown of the boiler, they pass through a rectangular opening, formed in front of the boiler, above the tubes, F. The heated matters flow down between the end of the boiler and the door, D, and through the inner tubes, C. From these tubes they pass up the backward end of the boiler, and completely surround the external shell; and, after imparting the heat thereto, they flow into the chimney, L. In this way, with the exception of the narrow sole plate, which rests on the brickwork, every portion of the boiler is exposed to the heat of the burning fuel. The extensive surface thus presented to the heat, and the division of the water, by means of narrow water spaces, necessarily causes the temperature of the water to be very quickly raised to the boiling-point, and with a very small expenditure of fuel. Boilers upon this principle are also adapted for raising steam with great rapidity, in arranging which, sufficient space for steam room is left at the upper part of the boiler, and the steam is carried off by a vertically-branching pipe, in the usual way. Under another modification the external and internal shells of the boiler are formed of an elliptical figure, with an intervening water space. The furnace is formed within the inner shell, and the end water spaces are connected by water tubes and inner fire tubes, corresponding to the arrangement delineated in the accompanying drawings. When set in brickwork or other suitable material, the heat is caused to circulate around the external shell in manner similar to that before described. The external figure of the boiler may be varied in many ways, without departing from the essential features of the invention.

Fig. 2.



These boilers are admirably adapted for heating public buildings, as they are very easily managed, and all the parts are easily got at for the purpose of cleansing; and for horticultural purposes we doubt whether any better for the purpose could be arranged.

LAW REPORTS.

Telegraph Cables: Glass *et al v.* Boswell.—This was a motion for a new trial in the Court of Common Pleas (Sittings in Banco). The former proceedings in this case were reported in our last part. The plaintiffs were manufacturers of electric cables, and the defendant was the manager of the London establishment of Messrs Glass and Elliott, who are also manufacturers of electric cables. The declaration charged that the defendant had instigated a person named Curtis, who had been employed as a rigger in laying down a telegraph cable between England and the Dutch coast, to drive a nail into the cable, so as to damage its efficiency, and that accordingly Curtis did drive in the nail and destroy the conducting power of one of the four wires contained in the cable. The result of this was that it cost a sum of between £7000 and £8000 to repair the damage. The case was tried before the Lord Chief Justice at the last sittings at Guildhall, when the jury found for the plaintiff, and it was arranged that the damages should be settled out of court.—Mr Bovill now moved for a rule for a new trial, upon the ground that the verdict was against the evidence, and also upon affidavits. One important question at the trial was at what time the defendant received from Curtis a piece of the cable. The defendant himself, on the matter being suddenly brought to his mind, could not recollect whether he received it before or after the ship sailed to lay the cable, and upon the evidence on the other side, it went to the jury that the defendant had the piece of cable before the ship sailed. It was now, however, clear upon an affidavit, and from some letters which the defendant had found, that he had not got the bit of cable until the vessel had returned from laying the cable Until the trial the defendant had no knowledge of what Curtis would say, and he therefore could not meet his statements as to his having damaged the cable; but now it appeared upon the affidavits and upon the circumstances of the case, that it was extremely improbable that Curtis could have damaged the cable as he said he had done. It was submitted that the nail could not possibly have been driven without great force, though Curtis said that he had driven it with his knife. Further, Curtis would not have had time to leave off cutting the "stops" as the cable ran out to enable him to drive the nail. There were also many men employed in the hold with him, and there were persons above whose duty it was to watch that the men did their duty. The hold was well lighted, and Curtis must therefore have been seen driving the nail, and besides the noise of striking it would have attracted attention. The learned counsel further commented at great length upon the evidence, contending that the defendant's version, and not that of Curtis, should have been believed.—The Lord Chief Justice said, as the evidence stood, he was not dissatisfied with the verdict, but the circumstances which had been stated as to obtaining the piece of cable were extremely relevant, and those circumstances induced the Court to grant the rule.—Rule granted.

The Adriatic: Hebson *v.* The North Atlantic Steamship Company.—In the Court of Chancery, before Vice-Chancellor Sir J. Stewart, Mr Bacon moved for an injunction to restrain the sailing of the steamship called the Adriatic, now at Southampton, on the ground that she was fitted with machinery in infringement of a patent to which the plaintiff claimed to be entitled.—Mr Malins, for the North Atlantic Steamship Company (limited), said that it would be highly inconvenient to restrain the Adriatic from going to sea until the question of the alleged infringement of the plaintiff's patent should be determined, and undertook on behalf of the defendants, if the ship were allowed to sail, to be answerable in damages for any infringement of the plaintiff's patent committed by them if his right thereto should be determined.—Mr Everitt appeared for an American Company from whom the North Atlantic Steamship Company had purchased the Adriatic.—The Vice-Chancellor accordingly directed the motion to stand over.

The Great Eastern: Howes *v.* Great Ship Company.—(Sittings in Banco.)—A report of this trial, in the Court of Queen's Bench, appeared in the Journal for April last. Mr Bovill, Q.C., now moved for a rule to show cause why the verdict should not be set aside, and a new trial had, on the ground that the verdict was against the weight of the evidence, and that one of the jurymen was a shareholder in the Company. The action, which was tried before the Lord Chief Justice at the Guildhall sittings after last term, was brought to recover a royalty for the use of the plaintiff's patent reefing topsails in the rigging of the Great Eastern. On the part of plaintiff it was alleged that the late Captain Harrison had directed the ship to be fitted with the plaintiff's patent, and the defendant put in the evidence of Mr Yates, examined upon commission, who stated that the rigging had been supplied by Mr Scott Russell, who had taken the contract to complete the equipment of the ship, and not Captain Harrison, and the plaintiff complained that he had not had an opportunity to cross-examine this witness.—The jury found for the defendants.—The Lord Chief Baron thought the verdict was right, although he did not know that he should have interfered if the jury had returned a verdict for the plaintiff.—The evidence went to show that the order was that of Mr Scott Russell, and not of Captain Harrison, and he did not consider that the jury were at all wrong in finding the way they had upon the facts that were brought before them.—Rule refused.

The Great Eastern.—Russell *v.* The Great Ship Company.—This was an action tried in the court of Common Pleas, before Lord Chief Justice Erle, and Justices Willes, Byles, and Keating. The action was brought by Mr Scott Russell, upon the award made in August, 1860, by the arbitrators in his favour, for £18,000. The former proceedings were reported in the *Journal* for April last:—

Mr H. Lloyd (with whom was Mr Lush, Q C.) now moved for a rule for a new trial, upon the ground that the Chief Justice had found the issues contrary to law, and that there was no evidence to support the finding. The point was a short one. By the contract for building the ship, it was agreed that all questions and differences between the parties should be referred to the three arbitrators. It was also provided that where that contract required Mr Russell should obey all orders from the directors, and if they were wrong the arbitrators should award compensation. There was also an express provision that there should be no claim for extras, and if the contractor executed any extras he was to do them at his own expense. After the contract was, as the plantiff contended, completed, Mr Russell made a large claim for compensation, including extras. The company considered the contract not complete, and, acting under a power in the deed of settlement of the company, refused to register the transfer of some shares which Mr Russell held in the company. A reference of disputes was then had before the arbitrators, and Mr Russell had before them his claim for the extras and a claim for damages for the refusal to register the transfer of his shares. Mr Russell brought before the arbitrators claims amounting to £49,000, and the company brought forward claims amounting to £135,000, being principally for non-completion of the ship. The arbitrators entertained and disposed of all the claims, and by their award disallowed the company's claims, and found for Mr Russell the sum of £18,000. It was now argued that the claim in respect of the extras, and also in respect of the shares, were beyond the jurisdiction of the arbitrators to consider, and that the award was void. The court took time to consider the matter.

The court gave judgment, and said they thought there ought to be no rule, and that there was evidence to warrant in law the findings of the verdict. The words "of the submission of all questions and differences" extended to all disputes arising out of the relation created between them by the contract for building the ship, and there was evidence that afterwards the acts of the parties were such as to amount in equity to a variation of the original provisions, and to fly from those subsequent understandings, on the ground that they varied the deed, might be a fraud in equity, and the arbitrators were judges of law and equity. They thought the convenience and justice of the case required that there should be no rule.

Mr Watkin Williams (with whom was Mr Bovill, Q.C.) moved for speedy execution on an affidavit of Mr Freshfield, the plantiff's attorney, stating that the defendants were a limited company with the shares fully paid up; that they had no other property than the ship, and that the ship was advertised to sail to America and might never return.

Mr Lloyd opposed the application.

The court thought it was, under the circumstances, the right of Mr Russell, and granted execution forthwith.

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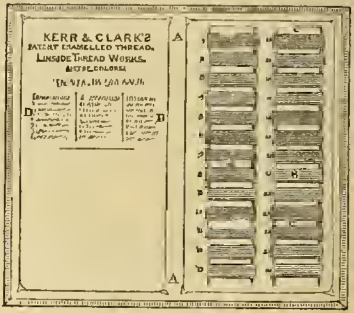
REGISTERED DESIGN.

THREAD SAMPLE BOOK.

Registered for Messrs Kerr & Clark, *of Linside Thread Works, Paisley.*

Messrs Kerr & Clark have introduced a very handy sample book, which shows at a glance the several colours of their tinted threads The accompanying engraving represents the book open. The purpose of utility to which the new parts of this design has reference, is that of displaying, in a convenient form, a series of samples of coloured thread, and affording an easy mode of selecting, or referring to any particular tint or shade of colour. The case, A, of the sample book, is similar to that of an ordinary book cover, and is made of any convenient size to admit of the proper display of the required number of samples. The specimens or samples of thread, as shown at C, are wound upon slips of cardboard, C, which are fastened to one face of the case A. The samples of thread are arranged in gradations of colour, and each sample has a distinguishing number placed opposite to it. The list of colours, numerically arranged, are printed on the opposite side of the sample book as shown at D. The part of the design which is not new or original, as regards the shape or configuration thereof, is that marked A, the rest is new.



CORRESPONDENCE.

THE ROTATION OF BODIES ON THEIR AXES.

My last communication was purposely short; still it appears to have been too long for Mr Harrison to read with attention. I there stated that a ball could not rotate upon a horizontal and vertical axis at one and the same time. Mr Harrison's illustration is as far from disproving this assertion as the east is from the west.

From the commencement of this discussion I have represented the moon and earth as balls, or spheres,—the only legitimate representation of these bodies—and therefore recognise no other. Hats, crank pins, and compass needles are as unnecessary to the matter in hand as gridirons, tea caddies, or opera glasses.

I now conclude this with a few words in regard to the compass. Mr Harrison talks of a "motionless magnetic needle." Who ever heard of a compass with a motionless magnetic needle? What seaman would go to sea with such an instrument? Why take the trouble to balance a needle so nicely upon a pivot, if one without motion would equally answer the purpose? Mr Harrison, like a true pupil of the Hill and Herschel school, arranges his apparatus to suit his own wishes. Let Mr Harrison (as he has enlisted the "motionless magnetic needle" into his service) take the north pole to represent the earth, and a circle round it as the moon's orbit; let him now sail (supposing it possible) round the north pole in this orbit; he will then find his "motionless magnetic needle" still more motionless, and his imaginary rotation vanish. The needle in this case (true to its master) will remain north and south, without "every part of the rim of a circular box (being) passed in succession beneath the points of a motionless magnetic needle."

Bertram Mitford.

Cheltenham, April, 1861.

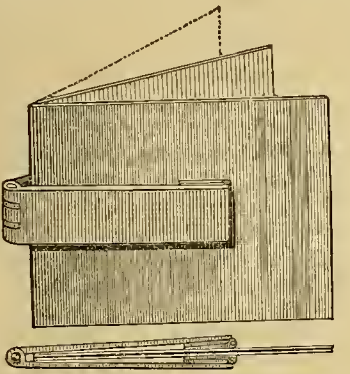
THE DEBUSSCOPE.

At the present time, when the Debusscope is fast taking the place of its predecessor, the kaleidoscope, as a scientific amusement for the drawing-room, it may not be out of place to draw the attention of your readers to the best and cheapest form in which one can be made for a trifle.

As mounted and sold under the French patent, the debusscope—or dubusscope, as some say it should be written—has many faults, the most conspicous of which are:—

First, The cross-bar interfering with the light and view. From being mounted in cardboard, this is almost necessary, but when made of zinc, as the first which I constructed, this barrier can be done away with.

Second, Difficulty of cleaning. Although usually provided with a chamois pad, this is quite insufficient to restore lustre to the silver, so easily tarnished in our coal-heated and gas lighted rooms. It is obvious that, if glass mirrors would serve the purpose, this reason would fall to the ground. But a glass mirror gives two reflections, one from its exterior surface and the other from the amalgam, which—and that the thicker the glass—interfere more or less with the beauty and delicacy of the reflections.



Third, Immobility. To the decorative artist, and as well for explaining the use and construction of the toy, it is important to have the angle variable. The angle, as in the kaleidoscope, must always be an aliquot part of 360°, say, 45°, 60°, or 90°.

Fourth, Its size.

It has been my object to annul all these; how far successful it will be for your readers to judge.

Having procured a camp desk hinge, 2 inches in length by ½ in breadth, two thin brass hinges, ½-inch square, and two daguerreotype plates, as thick as possible, to prevent the heat when soldering rendering the plated surface uneven, to the inside of each limb of the first is to be soldered a limb of the small brass hinges, in such a manner that the joint projects over the extremity of the desk hinge; the backs of the plates having been tinned, as well as the other limb of the small brass hinges, they are brought into the position which will be at once understood from the subjoined engraving, and soldered—the plates being of the same size, should appear almost as one when together.

On opening them, there will be seen a most complete debusscope, with the angle not only variable, but the plates accurately fitting at the apex for any angle, and opening out to the flat for buffing, which will be seldom required. When not in use, it should be shut, to prevent the action of the sulphuretted hydrogen. If not accurately fitting, they may be closed upon a piece of chamois leather, which may serve for cleaning when required. For portability it is without equal, and its price will be about 1s 6d.

To those who take the trouble to construct this scientific toy I would hint, that the best method of finding the accurate angles is to place one of the plates parallel with the edge of any right-angled piece of paper, and move the other plate till a Roman cross is formed, when the angle is 45°; by still opening this plate a three limbed pattern will be formed, the angle being 60°; and still further, the pattern will have two limbs, the right-angled piece of paper between the plates being multiplied three times, when the plates stand at right angles. In moving it about over the pattern, it should be held by the thumb above the joint of the great hinge, and fore and middle fingers below, each touching a plate gently. Coloured patterns, little figures, coins, in fact, scarcely anything comes amiss to this instrument, unlike its congener the kaleidoscope, or its rival the telescopic kaleidoscope.

J. R. Brown, M.D.

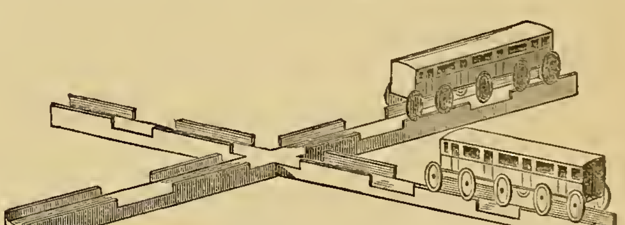
Saltcoats, April, 1861.

RAILWAY ACCIDENTS.

From the increasing and prodigious prevalence of railway travelling, and the terrible disasters accompanying it, I am induced to offer a few remarks, on the accidents particularly, which I firmly believe, are for the most part preventable, though not in all cases without expense. The chief accidents seem to result from causes easily within our control, viz.: 1st, from collisions; 2nd, from the carriages running off the rails; 3rd, from the breaking of axles, and the coming off of the tyres; 4th, from upsetting in turning short curves; 5th, from cattle, &c, getting on the railway; 6th, from persons getting on the railway; 7th, by carriages catching fire; and 8th, from having the carriages too high from the ground.

1st. Collisions, I think, might generally be prevented by my plan shown at the Great Exhibition of 1851, in which, instead of pouncing pell mell on each other, the one train turns the other, or turns itself, out of its course, and then they pass each other quietly, side by side. A medal was presented to me by His Royal Highness Prince Albert for this invention and that of my square wheels for escaping obstacles. 2nd. The running off the rails might be rendered nearly harmless by making a fencing or a mound of earth, about a foot in height, at the side of the railway, to confine the carriages when they had run off the rails 3rd. Few axles would break if well secured at the end by a standard or bar, so that they should have two good bearings; and props within, about an inch from the ground, might be added under the carriages, to catch the ground if a wheel should fail; tyres, also, might be so secured on the fellocs as to be quite safe; or the whole wheels might be of iron. But it seems incredible that frost can permanently weaken the iron, as is generally believed. If so, why do do not the axles and tyres of common carriages, or other iron exposed to the frost, suffer the same disasters? And before blaming the frost, would it not be well to inspect the manufactories, to see whether the fragile axles and tyres were not all made in one workshop? 4th. The upsetting in short curves might be prevented by confining the train to one speed in those places, neither faster nor slower, so that the impetus tending to upset the train on the one side is counteracted by the sinking of the other, these depressions being wisely made for this purpose, but they only suit in those places for one prescribed speed; because if adapted for one speed they will not suit another. If the depression be too great for the one speed, the carriages may upset on the depressed side; and if too small, they may upset on the other side. But even if all this is properly adjusted, the carriages will be inclined to upset after the curve is passed, from the side impulse of the former operation. Perhaps to remedy this, the part beyond the curve might be waved less and less, and the same rail which suits an up train would not suit a down one. But much harm might be saved by cranking the axles, so that the carriages nearly touched the ground, as in my vehicle for conveying disabled oxen, and now generally adopted. 5th. Cattle, &c., might be kept away by means of a fence. 6th. And persons could be saved if they got on the railway, by having a footpath for them on which they could retreat, and in tunnels, particularly, this is necessary. 7th. Fire might be guarded against by thin iron plates, or perhaps by infusing into the wood some of the chemical fluid which has been effectual in preventing houses from being burnt.

I will now add a plan of mine of a cheap railway, little if at all inferior to the common plan, where only half the quantity of iron will suffice for the rails. My rails in this are not continuous, but are in short lengths, with cavities between them, which cavities may be filled up with wood, if preferred, and there are rather more wheels than rails in a given space, the wheels being so placed that they never fall into the cavities, because the external wheels always bear when the intermediate ones are over the cavities, and thus support the carriage. By this plan two trains may cross each other's path at different times, the rails being at right angles with each other, and without stopping the trains, provided that the two cavities in each train come in the same place.



If information should be required as to the mode of applying the rails in curves, I think I can not do better than to refer to Thomas Baker's work on the subject; his system being the one, I understand, that will be generally adopted.

Lewis Gompertz.

Oval Kennington, April, 1861.

EXPLOSIVE SHELLS FOR RIFLED ORDNANCE.

In the *Scientific American* of the 20th inst., under the head of the Polytechnic Association of the American Institute, is the following passage. "Mr Badcock said that there was no doubt of the originality of the style of projectile of General James, but he was not the first to make explosive shot—that was done twenty years ago by Norton."

I have made an improvement on the percussive explosive shell that I used at Woolwich twenty years ago, by charging it with bullets, something on the Shrapnel principle, and have left specimens of it at the Royal United Service Institution, and South Kensington Museum.

J. Norton.

Ruthesville, April, 1861.

THE MAGNETICAL DEVIATIONS OF THE COMPASS.

In your *Journal* of last month you have given a brief abstract of a paper on the Deviations of the Compass, read by F. J. A. Evans, R.N., at the Institution of Naval Architects. The great importance of this vexious question cannot be too prominently kept before the mind's eye, as by this means we may acquire an understanding of the science by which our knowledge may be greatly extended, and principles deduced from the facts brought forward on this important question—the knowledge which is being daily accumulated from the different observations that have been established at convenient points on the earth's surface for magnetical observations.

As you have kindly invited communications on the subject, I willingly embrace the opportunity, knowing that I hold views on this question which were not at one time very favourably received, but as time passes on they gain. At the last meeting of the British Association, when the question of compass deviations was under discussion, it was affirmed by one whose theoretical and practical knowledge of the science of magnetism is second to none, that the present system of corrections was not to be relied upon. It is well that we have such authority, as it opens up the whole question for reconsideration, and there cannot be a doubt it is much required, as the present method is far short of the desired object, and there is much room for improvement. It is therefore a question well worthy of the attention of all interested.

Theoretical deductions are not at all times to be relied upon, more particularly in the science of magnetism, as it must be admitted that the extent of our knowledge of its real facts is at best limited, for where we ask ourselves how much we know, we discover, in the inquiry, that we have to unlearn much of that which, at one time, appeared to form the greatest part of our knowledge, which is now consolidated into a few apparent facts. But there can be no doubt that from the arrangements of the means that have been adopted at the different observatories will, in the course of time, enable us to form more correct ideas on this great question of electrical influences. It may well be called a great question; we are daily becoming acquainted with its energies on matter throughout space, as well in the bowels of the earth as on its surface; we trace it in the balmy air, and its reaction in the thunderstorm; we trace it in the shades of colour which delight the eye, and in those sensations which stimulate us to action. From those laws we are endeavouring to divine the probability of the storm, as there can be no doubt electric influence forms the chief key to all the varied changes.

The probabilities of the storm, as reasoned from the position of the sun and moon, will not at all times be correct. This we had an example of on 27th March last; a heavy gale was fully expected, and its not taking place has produced for a time a want of confidence, which a little time will yet restore. In that prediction, I think that if the positions of the planets Jupiter and Saturn had been taken into account, it would have modified the probability of a burst, as their positions, right ascension and declination, were calculated to give reaction, and thus modify the inducing influence. Seeing the close relation that subsists between the question of compass deviations and the laws of storms, I will endeavour to combine in these papers, as far as possible, the electrical fundamental principles, as they will equally serve for both.

The commander of a ship is already in possession of much of the practical information necessary for working out those important principles, and only requires direction. In this we have to do with men who are largely intrusted with life and property; men who display to us their mechanical knowledge in the bending and setting of their sails in a wedge inclined plane as best to speed them on their way; men who have daily practical experience of the magnetical laws; men who watch with anxious care the indications of the barometer; men who watch with careful eye the rising and setting of the sun; men who measure in the night the angular distance of the moving planet and fixed star that guides them on their way; men who, in the dawn of morning, watch the distant sky, and dread the low hanging woolly clouds, with suspicious eye. To the barometer he steadily goes; it is falling, falling rapidly. To his chief he quietly says, "The wind's south-west, take in some sail, there is every appearance of a gale." These are the men we are bound to assist; they are, from their position, well acquainted with fundamental facts, and all that is required is to give them a leading direction to those principles. So far as we know them, they are fully prepared for it. How is it to be done? On this we must speak loud, knowing the difficulty of making ourselves heard in the proper quarter. I believe it has been suggested to make it a part of the master's examination. This I would most decidedly oppose. For many years I have had an extensive acquaintance with masters and officers, and know that many of them could pass a fair examination before a marine board, while there are many of them never could make much appearance at an examination, although their knowledge and powers of observation might surpass those who had undergone the ordeal.

We have much to learn on these important questions. On many of their leading facts, Phaeseists are themselves divided, so that no correct form can as yet be clearly decided on. We are daily acquiring knowledge on these questions, and he would be a bold man who would say that we have all that is necessary to form clear fundamental principles. What I would propose is, that the examinator studies to keep his knowledge up with the advancement of the science, and that he should communicate those laws or principles of observation to all masters and officers, each holding a certificate that he had attended that course of instruction. On these questions, I have invariably found masters anxious and ready to receive information. There can be no doubt that the extension of knowledge on this important topic will tend to the preservation of much life and property.

In proceeding to the examination of these important questions, I will endeavour to convey those principles in as plain and simple language as possible, as there can be no doubt there is by far too much mist hanging over them; and if the master was in possession of a general knowledge he would be enabled to do something for himself when extreme deviations were indicated; besides, the position of the adjuster would be improved, as the commander would only look for that amount of perfection which the circumstances of the case would warrant, as at present he at times looks for perfection where it is not possible, and discovers his mistake when it is too late. By an extension of his knowledge, he would be capable of discriminating between those cases of compass deviations which he might trust, and those which he must watch with suspicious eye, as extreme compass deviations often arise from position, and can never be very satisfactory, so that its indications are not to be relied on.

In my next, I will proceed with an examination of the general principles and modes of observation. PAUL CAMERON.

OCEAN TELEGRAPHY.

I beg to lay before your numerous readers a plan I have invented, with a view to its application to the transatlantic telegraph. No doubt many reasons may be stated for and against the scheme, and I shall be happy to hear its merits fairly discussed on both sides.

The plan I have to propose is to float the cable about 60 feet below the surface, by attaching buoys to it which will support nine-tenths of its weight, the remaining tenth to be supported by very small buoys, which rise to the surface, and though struck by a passing steamer would receive no injury. The larger buoys are allowed to sink with the cable, and the length of the connecting line will determine the depth. 60 feet will place it below any surface agitation of storms. Again, I propose to employ what I might call the electric bridge, and is so far like one, because it takes the total distance in spans where one arch is insufficient. It consists of galvanic batteries submerged with the cable, every 300 miles or so, and the current traverses each battery in succession. The batteries are water-tight, and are moored to light anchors. By a simple mechanical arrangement they can be raised and replenished by a steamer in the company's service. Where commercial considerations would warrant it, instead of these a floating station for transacting business could be had, but connected on the same principle, for through messages.

The greatest objection to floating the cables, I apprehend, is the strain that currents would exert upon it. Now as the tidal currents are from east to west, the strain would be on the cable laterally; but any side strain would be supported by stay lines at intervals. The buoys may be about a mile apart, and the cable very slack. Any side strain would float the cable till it assumed the catenary curve, and be so much stronger to resist it. The buoys should be shaped like a cigar, to give least resistance to currents. I propose that the cable should be simply a strong conducting wire and vulcanised insulator; anything additional would add to its weight and cost without any good. Any accident occurring to the line, it could be readily raised and repaired, without sacrificing the whole, as in the present cable. It would be as completely under management as any line upon land. The shore ends, for about 50 miles, and any shallow banks, would be laid on the bottom. It would keep as far south as to be beyond the ordinary range of icebergs. I need not occupy your valuable space with more of these details, they will occur to every practical reader.

I have thought fit not to protect the invention, because such a step only serves to hinder its introduction. If the present Atlantic Telegraph Company chooses to adopt it, or some modification of it, they may do so; and I am warranted in stating, if they do not, the scheme will be prosecuted by another company about to be embodied for that purpose.

Before closing, I will propose a few difficulties that seem to me to obstruct a successful line being made by the North Atlantic, taking Iceland and Greenland as intermediate stations. Indeed, the proving the impracticability of this as a route, forms a necessary adjunct to the success of the one I propose, because both cannot go on at once:—

1st, Can any reason be given for taking the line so far out of a direct track but to get the entire circuit broken up into shorter lengths, and is such not actually accomplished by the method I propose in floating stations when their stability is admitted.

2d, The sub-marine cables in the India route are a series of cables similar in length to the proposed north route, but laid in the quiet Mediterranean, and yet on one part or other of the route they are often going wrong. Can more permanent success be had for the other, exposed to the untold dangers of icebergs, &c., which our want of practical experience in these seas cannot as yet fully determine.

3d, From the nature of circumstances, in the case of an accident occurring, can any idea be given how soon it could be repaired, seeing only for some weeks, during some years, access to some parts of the line can be had for examination or adjustment,

4th, What effect will the extreme frosts and snows have on the land sections? We have all seen a clothes line coated several inches deep during a snow storm at home.

5th, To what extent will the usual telluric currents operate, seeing the line traverses such extremes of temperature, and especially as it passes the precincts of the magnetic pole itself?

6th, The expense of making and maintaining the line would be enormous. What with the strength of shore ends to resist the effects of floe ice; the total length of the line, from the extremity of present lines here to the most northerly of the telegraph stations in Canada; the carrying of everything to the spot, even the poles for land transit would have to be conveyed from Scotland or America; the greatly enhanced salaries of the servants of the company in these desolate regions, &c.

7th, From the short and uncertain period each year, how many years might be considered necessary to complete it.

8th, The shore ends of the original cable are believed by some to be the chief difficulty—here it is fourfold!

Lastly, I need not enumerate more; it could be done, and much easier than give a satisfactory solution to the few I have noted. Let its advocates come to the proof. But why this straining after the most difficult route imaginable. Far fewer difficulties met the original scheme, and yet it failed, and what the fate of its twin-brother will be it is not difficult to tell—cradled in the same bed, and nursed by the same stern adversity—should it ever reach to be hatched. Some 200 miles of the north route are just as deep as the direct route.

JOHN CLARK.

Glasgow, April, 1861.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

MARCH 1, 1861.

"On Bunsen and Kirchhoff's Spectrum Observations," by Henry Enfield Roscoe, Esq. In the *Journal* for last month we gave a brief summary of these highly important experiments, and we now present them in a more extended form.

The researches of Bunsen and Kirchhoff marked a new era in the science of Analytical Chemistry; that by means of these discoveries the composition of terrestrial matter becomes revealed to us with a degree of accuracy and delicacy as yet unheard of, so that chemical elements supposed to be of rare and singular occurrence, are shown to be most commonly and widely distributed, and on the first practical application of this new method of analysis two new and hitherto undetected alkaline metals have been discovered.

The importance of these researches becomes still more strikingly apparent, when we hear that the conclusions derived from them outstep the bounds of our planet, enabling us to determine with all the certainty of definite experiment the actual presence of a number of elementary bodies in the sun.

The colours which certain bodies impart to flame, have long been used by chemists as a test for the presence of such bodies. Thus soda brought into a colourless flame produces a bright yellow light, and substances containing soda in any form give this yellow colour. Potash gives a violet flame, lithia and strontia impart to flame a crimson colour, whilst salts of barium tinge it green. These colours are produced by the incandescence or luminosity of the heated vapour of the various bodies placed in the flame. It is only because these substances are volatile, or become gases at the temperature of the flame, that we observe the peculiar colour. If any substance, such as platinum, which is not volatile at the temperature of the flame, be placed in it, no colouration is observed. The higher the temperature of the flame into which the same substance is placed, the greater will be the luminosity; and the more volatile the salt of the same metal, the more intense is the light produced.

These facts have long been known and applied, but it was reserved for Bunsen and Kirchhoff to place these beautiful phenomena in their true position, to apply to them the modern methods of exact research; and thus to open out a new and rich field for most important investigations. This they accomplished in a most simple and beautiful manner, by examining these coloured flames, not by the naked eye, but by means of a prism, or an apparatus for separating, decomposing, or splitting up the light produced by the incandescent vapour into its different constituent parts.

If we pass white sun-light through a prism, we get the well-known solar spectrum discovered by Newton. The red, or least refrangible rays appear at one end, and we pass through all gradations of colour—noticing on our way certain dark lines or spaces, showing the absence in solar light of some particular rays, lines with which we shall have much to do—until we arrive at the violet, or most refrangible end of the spectrum. If, instead of using white sunlight, we pass the rays from the yellow soda flame through the prism, we get the soda spectrum; and we find that, instead of a continuous spectrum, all we see is one bright yellow line, showing that every kind of light except that bright yellow ray, is absent in the soda flame; or that the soda flame gives out only one kind of light.

And as each metal, sodium, potassium, lithium, calcium, strontium, barium, &c., communicates a distinct tint to a flame, so each gives a distinct and characteristic spectrum, consisting of certain bright coloured lines, or bands of light of the most peculiar form and tint.

The actual spectra of these metals can be beautifully seen in the simple apparatus designed by Bunsen and Kirchhoff.

In each spectrum of these metals, the form, number, position, colour, and tone of the bright lines remain perfectly constant and unvarying, so that, from the presence or absence of one of these lines, we may with absolute certainty draw conclusions respecting the presence or absence of the particular metal, as we know of no two substances which produce the same bright lines. None of the bright lines produced by any one metal interfere in the least with those of any other, and in a mixture of all these metallic salts together, each ingredient can thus be easily detected.

As an example of the exactitude with which a very small quantity of a most complicated mixture can thus be analyzed, the speaker quoted Bunsen's words. "I took," says Bunsen, "a mixture of chloride of sodium, chloride of potassium, chloride of lithium, chloride of calcium, chloride of strontium, chloride of barium, containing at most $\frac{1}{10000}$ part of a grain of each substance. This mixture I put into the flame, and observed the result. First, the intense yellow sodium line appeared, on a background of a pale continuous spectrum; as this began to be less distinct, the pale potassium lines were seen, and then the red lithium line came out, whilst the barium lines appeared in all their vividness. The sodium, lithium, potassium, and barium salts were now almost all volatilized, and after a few moments the strontium and calcium lines came out, as from a dissolving view, gradually attaining their characteristic brightness and form."

We can thus detect the most minute traces of any one of these bodies, if mixed with the largest quantities of any other substance. The delicacy and accuracy of these reactions is without a parallel, as is seen from the following statements:—

1. *Soda* $\frac{1}{3,000,000}$ part of a milligramme, or $\frac{1}{190,000,000}$ part of a grain of soda can be detected. Soda is always present in the air. All bodies exposed to air show the yellow sodium line. If a book be dusted near the flame the soda light can be seen.

2. *Lithia* $\frac{1}{100,000}$ part of a milligramme, or $\frac{1}{60,000,000}$ part of a grain of lithia can easily be detected. Lithium was only known to occur in four minerals. It is now found by spectrum analysis to be one of the most widely distributed elements. It exists in almost all rocks; it has been found in 3 cubic inches of sea, river, and Thames water; in the ashes of tobacco, and most plants; in milk, human blood, and muscular tissue.

3. *Strontia* $\frac{6}{100,000}$ of a milligramme, or $\frac{1}{1,000,000}$ part of a grain of strontia can easily be detected.

4. *Lime* $\frac{1}{100,000}$ of a milligramme, or $\frac{1}{1,000,000}$ of a grain may be easily detected.

In examining the spectra of the alkalies obtained from certain mineral waters, Bunsen observed the occurrence of two bright blue lines which he had not seen before, when he examined alkalies from other sources. Hence he concluded that these bright lines must be produced by a new, hitherto undetected, alkaline metal. Subsequent search proved the validity of the supposition. The new metal was found and isolated. The analogy between this discovery and a celebrated one in another branch of physical science, will be at once understood. As Adams and Leverrier discovered Neptune, so Bunsen discovered "*Cæsium*," by the perturbations produced in the spectra of the other alkaline metals.

This is, however, not all. A few days ago the lecturer received a letter from Bunsen, which contains the following most interesting information:—"The substance which I sent you as impure tartrate of Cæsium contains a *second* new alkaline metal. I am at present engaged in preparing its compounds. I hope soon to be able to give you more detailed information concerning it. The spectrum of the new metal consists of two splendid red lines situated beyond the red line K *a* in the ultra red portion of the solar spectrum. Hence I propose to call the new metal '*Rubidium.*'"

That this same method of investigation can be extended to all the metallic elements is more than probable, for Kirchhoff writes—"I have assured myself that even the metals of the rarest earths, as yttrium, erbium, and terbium, can be most quickly and certainly determined by help of the spectrum analytical method."

Experiments are being carried on with the view of making this mode of examination practically applicable to all metals.

To turn, now, to the second, and, if possible, to the more interesting part of the subject, namely the conclusions drawn from these observations respecting the composition of the sun's atmosphere. The solar spectrum invariably contains a large number of dark lines, or spaces, or shadows. These have been called Fraunhofer's Lines, from the name of their discoverer. They show us that in the sun's light certain kinds of rays are wanting; and as these lines are always present, exactly in the same position, we see that certain kinds of rays are always absent in solar light. There are many thousands of these lines in the whole length of the spectrum. Only a few have been, as yet mapped and named.

What is the cause of these constant dark lines? And we must remember that it is in sunlight alone that these particular lines occur; in the light of the fixed stars, as well as in artificial lights, other lines are found. It is the discovery of this cause by Kirchhoff which gives the subject such peculiar interest, as it enables us to draw conclusions respecting the composition of the sun's atmosphere. "The sun," says Kirchhoff, "consists of a glowing gaseous atmosphere, surrounding a solid nucleus which possesses a still higher temperature. If we could see the spectrum of the solar atmosphere without that of the solid nucleus, we should notice in it the bright lines which are characteristic of the metals it contains. The more intense luminosity of the internal nucleus does not, however, permit the spectrum of the solar atmosphere to become apparent; it is *reversed* according to my newly discovered proposition; so that, instead of the *bright* lines which the luminous atmosphere by itself would have shown, *dark* ones appear. We do not see the spectrum of the solar atmosphere itself, but a negative image of it. This case, however, with an equal degree of certainty serves to detect the metals present in the sun's atmosphere. All that we require for this purpose is a very accurate knowledge of the solar spectrum, and of the spectra of the individual metals."

Kirchhoff is at present engaged in continuing these observations; and although only eighteen months have elapsed since the first discovery was made, he has already mapped more than seventy lines in the solar spectrum, between D and E, which are produced by iron. He has shown that the well-known group in the green, known as *b*, is caused by magnesium, whilst other coincident lines prove the presence of nickle, chromium, potassium, and sodium in the solar atmosphere.

ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the ordinary monthly meeting of the Executive Committee—William Fairbairn, Esq., C.E., F.R.S. president of the Association in the chair—Mr L. E. Fletcher, chief engineer, presented his monthly report, from which the following is abridged: "During the last month six special visits have been made, and 199 ordinary visits, making a total of 205 visits. Nine boilers have been examined specially, 504 boilers have been examined externally, 24 internally, and 21 thoroughly, making a total of 558 boilers examined. One engine has been examined specially, and 435 at ordinary visits, from 30 of which indicator diagrams have been taken. The following are some of the principal defects which have been found to exist in the aforesaid number of boilers inspected, and to which the attention of the owners has in each case been called, not only at the time of the visit, but also by subsequently written report:—Fracture, 10 (2 dangerous); corrison, 10; safety valves out of order, 26 (2 dangerous); water gauges out of order, 27 (3 dangerous); pressure gauges out of order, 13 (1 dangerous); feed apparatus out of order, 5; blow-off cocks out of order, 23; fusible plugs out of order, 4; furnaces out of shape, 10; over pressure, 1; deficiency of water, 3 (1 dangerous). Total, 132 (9 dangerous). Boilers without glass water gauges, 9; without pressure gauges, 6; without blow-off cocks, 11; without feed check valves, 53. Although nothing of startling interest has occurred during the past month, still the ordinary working of this Association during that period has shown the commercial value of a regular system of boiler inspection, and thus it has an importance entirely apart from all considerations of the saving of human life and property endangered by boiler explosions. In illustration of this, it was stated that several boilers have been met with, the proprietors of which had gone to the expense of having them fitted with brass scum and mud or blow out taps, as well as the full complement of necessary mountings, and who were under the impression that these were properly attended to, and that all was done that could be to keep their boilers free from deposit and promote their efficiency and durability. Upon inspection, however, it has frequently been found that these scum and blow-off taps have been quite neglected, and have become choked up with sediment. This has taken some of the proprietors quite by surprise, and they have felt obliged by being undeceived. Some blow-off taps are found to be very dangerous from their construction; the shells being of cast iron, and the plugs of brass, which, on account of their unequal expansion, stick as soon as they are opened, and cannot be closed again, and thus the whole of the water is blown out, the furnace crowns are left dry, and the fires have to be drawn. Three tubular boilers were examined during the last month, which have been so injured as to run a stream at the tube ends and other places, mainly from the neglect of suitable blowing out, and will require the removal of all the tubes, and a large outlay upon them before they will be again fit for use. The value of scum pipes was pointed out, not only on account of their beneficial effect on the boilers themselves, but also on the piston and slides of the engines, by preventing a quantity of earthy matter being carried over in small particles with the steam. It was stated that the water should be blown off from the surface when it is in a state of ebullition, and from the bottom when in a state of rest."

GEOLOGISTS' ASSOCIATION.

April 8.

At the Monthly Meeting, held at 5 Cavendish Square, on Monday, April the 8th, the following papers were read—

"On the Geology of the Isle of Portland," by W. Gray, Esq.

"On the Pearls of the Greensand Sea," by Harry Sealey, Esq.

"On Fossil," by Harry Sealey, Esq.

On Tuesday, the 9th of April, an excursion was made to Reigate, under the guidance of the President, Professor Tennant, and Mr Winsted. The party proceeded to examine the various sections showing the junction of the chalk and greensand, which are exhibited in the neighbourhood, and then viewed a remarkable bed of Fuller's Earth, which is worked near Nutfield. After having been hospitably entertained by a gentleman resident on the spot, the party returned to town about 9 in the evening.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

March 12, 1861.

Mr Thos. R. Wilkinson furnished statistics connected with the sale of beer and spirituous liquors, with a view to inquire whether such sale had any effect on the criminal returns, and how far the legislature would be justified in a further interference with it.

March 18, 1861.

A communication from Captain Anderson, R.M.S. *Canada*, written at sea, on his homeward voyage, excited considerable interest. He states that Dr Wallich's pamphlet would be communicated to the Boston Society of Natural History by Professor Agassiz, who was particularly interested in the Ophiocoma found at so great a depth. The Professor is now engaged in preparing a work upon the natural history of that class of echinoderms, which he has studied for many years, and claims to have the finest collection of those animals in existence, made on the coasts from Greenland and Labrador to Mexico and round Cape Horn to California. Since the publication, in 1848, of the "Principles of Zoology," by Agassiz and Gould, the Professor has ascertained that the system of tubes and water pores, described at page 123, exists in all animals which much vary their depths of water in the sea, and in the herring they may be seen with the naked eye along the side of the neck.

With reference to the removal of tallow from soundings, Dr Hayes, the Assayist for the State of Massachusetts, stated to Captain Anderson, that heated turpentine, poured amongst the soundings, will remove all the tallow with it through filtering paper. The operation should be twice repeated, and the residue finally washed with sulphuric ether.

Dr J. Bacon presented a copy of his report upon the chemical composition and Microscopical characters of the pearl, said to have been formed in the interior of a cocoa-nut at Singapore, in the possession of Frederick Bush, Esq., and exhibited by Dr Winslow.

Captain Anderson, in a very able manner, gives the outline of a plan which has occurred to him for rendering available to science the services of commanders of merchant vessels and seamen generally, in collecting specimens of natural history, and information in natural science—whether in zoology, ethnology, botany, or meteorology—for which they have such facilities in all parts of the world, for the use of those scientific institutions which may desire to join in it, and also with a view to elevate the mercantile marine of England in the social scale, by stimulating a taste for such knowledge amongst sea-faring men. The consent and co-operation of shipowners will of course be necessary, and Captain Anderson seeks the additional influence of merchants and scientific bodies. The subject met with the unanimous approval of the members present; and it was resolved that the portion of Captain Anderson's letter relating to it should be published at the expense of the Section, for the purpose of eliciting opinions upon the feasibility of the scheme, and upon the best practical method of carrying it into execution.

Commander M. F. Maury, U. S. navy, forwarded copy of a letter from Lieutenant John M. Brooke, the inventor of the detaching deep sea sounding apparatus, and enclosing for the Section a number of soundings from the North Pacific Ocean, which were obtained with small twine and spherical weights of about 70 lbs., which were detached upon contact, and left at the bottom of the ocean; Lieutenant Brooke observes, that "Nine consecutive casts (soundings), varying from 2000 to 2900 fathoms, were made with the same piece of twine and detaching apparatus, which last weighed less than 1 lb." As the specific gravity of a wet flax line is nearly that of water, a line that can be pulled down by a weight, may be pulled up by hand, provided the weight be detached at the bottom. One of the specimens obtained in 3030 fathoms, nearly three and a half miles, is the greatest depth from which material has yet been brought up from the ocean bed. Lieutenant Brooke sent also a few specimens obtained by soundings in shallow waters, on the east coast of Niphon, Japan, by him, during his boat voyage from Simoda to Hallodadi in 1855, under the orders of Commander Rodgers, U. S. navy.

Mr **Binney** described to the Section the appearance of certain nodules found in the middle of a seam of coal, in the lower part of the Lancashire coal field, which contain fossil wood associated with marine shells.

Mr G. V. Vernon, F.R.A.S., produced manuscript copies of thirteen years' barometical observations made at Greenwich, which had been kindly communicated by the astronomer royal, showing the observations once a day for every day instead of the daily means, and presented such series to the section, for which present he received its thanks.

April 2, 1861.

Mr T. T. Wilkinson, F.R.A.S., exhibited an amulet, which, having been worn by an African chief who was captured in war about a century ago, had been recently examined, when it was found that the centre boss, of about an inch and a half diameter, contained an Arabic manuscript, the translation of which was undertaken by Professor Theodores.

Mr Wilkinson also laid before the meeting several geometrical theorems.

W. Fairbairn, LL.D., &c., "On the temperature of the earth's crust, as exhibited by thermometrical observations, obtained during the sinking of the deep mine at Dukinfield."

During the prosecution of researches on the conductivity and fusion of various substances, an opportunity occurred of ascertaining, by direct experiments, under favourable circumstances, the increase of temperature in the crust of the earth. This was obtained by means of thermometers placed in boreholes, at various depths, during the sinking of one of the deepest mines in England, namely, the coal mine belonging to F. D. Astley, Esq., at Dukinfield, which has been sunk to a depth of 700 yards.

The increase of temperature in descending, shown by these observations, is irregular; nor is this to be wondered at, if we consider the difficulties of the inquiry, and the sources of error in assuming the temperature in a single borehole as the mean temperature of the stratum. At the same time, it is not probable that the temperature in the mine shaft influenced the results. The rate of increase has been shown in previous experiments to be directly as the depth, and this is confirmed by these experiments. The amount of increase is from 51° F. to $57\frac{3}{4}$°, as the depth increases from $5\frac{3}{8}$ to 231 yards, or 1° in 99 feet; but, in this case, the higher temperature is not very accurately determined. From 231 to 685 yards, the temperature increases from $57\frac{3}{4}$° F. to $75\frac{1}{2}$°. This is a mean increase of 1° in 76·8 feet, which does not widely differ from the results of other observers. Walferdin and Arago found an increase of 1° in 59 feet; at Rheme, in an Artesian well 760 yards deep, the increase was 1° in 54.7 feet; De La Rive and Marcet found an increase of 1° in 51 feet, at Geneva. Other experiments have given 1° in 71 feet

Assuming as an hypothesis, that the law thus found for a depth of 790 yards, continues to operate at greater depths, we arrive at the conclusion that at $2\frac{1}{2}$ miles from the surface, a temperature of 212° would be reached, and at forty miles a temperature of 3,000°, which we may suppose sufficient to melt the hardest rocks. On entirely independent data, Mr Hopkins has been led to conclude that the minimum thickness of the crust does not fall short of 800 miles, in which case the superficial temperature of the crust would have to be accounted for from some other cause than an internal fluid nucleus.

J. C. Dyer, Esq., "Brief notes on the nature and action of steam in relation to boiler explosions."

He stated that several essays had lately appeared on boiler explosions, wherein discordant theories and opinions are offered on the action of steam in some anomalous cases of explosion, and which may justify the bringing before the Society a few established facts and principles relating to the subject, in the hope of arriving at more settled views concerning causes and effects in such cases than appear to prevail at present among our most distinguished engineers. The Author objected to the appeals made to Dr Dalton's theory of atoms for explaining the nature of steam as an elastic force mechanically employed, since the law of definite proportions of Dalton had no reference to elastic *vapours* except as to the constituents of the *liquors* whence they arise. He then cited the fact that water, like steam, is an elastic body, and the pressure would therefore be of the same nature and force above and below the water line in a boiler; but that explosions from fractures above or below that line would have different effects, owing to the amount of expansion of water and steam being so widely different when issuing from similar apertures and under the same pressure. Many obscure cases of explosion would be explained by the more or less rapid generation of steam issuing under those circumstances, as set forth in the paper. That free *space*, when suddenly and amply afforded, is to highly heated *water*, under great pressure, nearly the same as *fire* is to *gunpowder*. And this will account for the most destructive cases of boiler explosions; whilst those of a more harmless nature show that the fractures were small at first, and then gradually extended.

He also objected to the term "superheated steam," as being inapplicable to it in any state; because, when steam is in contact with water, it will be of the same temperature as the water; and if heated apart from water, the same laws of expansion by heat apply to steam as to air, and neither can be "superheated, though made very hot.

Again, steam can never be "mixed up with the water" in a boiler when both are under the same statical pressure, and the steam formed will rise into the chamber, so that the water will always be in contact with the boiler except when steam is drawn off. Still, in rapid escapes, it may drive out water and become entangled therewith, as in many explosions.

It having been shown that most, if not all, explosions are occasioned by simple steam pressure, acting on the weakest parts at first, and thence extending more or less rapidly, it would seem needless to seek for any other cause or force to account for them; yet, in some cases, the effects appear to imply a more sudden and violent action, like that of explosive compounds. In such instances, may they not arise from the actual decomposition of the water by heat alone? Although we have high authority against this, yet the Author held it rash to conclude that water could not be resolved into its constituent gases by direct action of heat from the boiler upon water pressed into contact with the metal plates. It has been proved, long since, that by heat. in the most intense form known to us—that of electricity—water is decomposed and *both* of its constituent gases are liberated. Therefore, since no evidence has been adduced to show that this does not take place in any water when so confined and heated, the affirmative may at least be possible, and seems probable, in some instances, as before named.

However, he held it desirable that the question should, if possible, be set at rest by experiment; and to this end a method was suggested for putting the matter to a direct test; but he might not be able to make the experiment himself, and hoped it might be done by some one more competent to the task.

MONTHLY NOTES.

MARINE MEMORANDA.

On the 13th ult., a handsome steam yacht (screw) of 200 tons was launched from the building yard of Mr Thomas B. Seatb, Rutherglen, on the Clyde. She is named the *Shamrock* and owned by the Marquis of Conyngham, Commodore of St George's Club. A steam yacht of 80 tons, for Lord Fitzgerald, Vice-Commodore, is constructing by the same builder.

The line-of-battle ship *Meeanee*, 80, which has been converted from a sailing vessel to a screw steamer, and fitted with engines of 400-horse power, was taken out of Sheerness harbour on the 10th ult., and proceeded on a trial trip to the Nore to test her machinery, under the direction of the officers connected with the steam department at Sheerness. The trial lasted nearly seven hours, and was a most successful one, the machinery working remarkably well. The draught of water aft was 23 ft. 10 in.; forward, 20 ft. 10 in.; pressure, 20; vacuum, 25; number of revolutions per minute, 56. The Meeanee is attached to first-class steam reserve in the Medway, and has all her stores, spars, gear, and armament on board. She can be prepared ready for sea in 48 hours, as she requires nothing but her provisions and ammunition to be placed on board.

The *City of New York*, an iron screw steamer, was launched from the building yard of Messrs Tod & M'Gregor, at Meadowside, Partick, on the 12th ult., Mrs Livingstone, wife of Dr Livingstone, the illustrious African explorer, performed the ceremony of naming. The *City of New York* is 320 feet in length, keel and forerake; breadth of beam, moulded, 40 feet; depth, moulded, $27\frac{1}{2}$ feet; tonnage, O.M., 2,560 tons. She will be fitted up with horizontal direct acting engines of 550-horse power, and will be supplied by Mr Davison with patent surface condensers. She will have accommodation for 160 passengers. She is built for the Liverpool, New York, and Philadelphia Steam Navigation Company. Messrs Todd & M'Gregor have also laid the keel of another screw steamer, being one of two vessels which they are to build, each 500 tons, for the Spanish trade.

Admiralty orders have been received at Chatham, directing the frigate, *Arethusa*, 51, which is now in dock undergoing the process of conversion from a sailing ship to a screw steamer, to be supplied with the following armament, viz.:—10 68-pounders, each of 65 cwt., and 9 feet in length; 22 of 56 cwt. each, and nine feet six inches in length; 18 of 45 cwt. each, and eight feet six inches in length; and one swivel 68-pounder, of 95 cwt., and ten feet in length. The Arethusa, which has been several months in hand, is in a very forward state, and a few weeks more will, it is confidently expected, see her completed. The addition made to her length amidships, in order to adapt her for a screw steamer, has made her one of the longest 51-gun frigates in the British navy.

Messrs Blackwood and Gordon launched recently from their shipbuilding yard, Port Glasgow, a handsome paddle steamer for the Cork river trade. She went into the water in fine style, and was named the *Citizen*. She is built for the Cork Citizens' River Company, and is rather novel in her construction. The cabin is fitted with 50 plate-glass windows, 22 inches by 19. This gives the vessel a very fine appearance, and will add greatly to the comfort of passengers. The steerage is well ventilated and neatly fitted, and altogether this vessel is well fitted for passenger trade. The vessel was taken off, immediately after being launched, to receive her machinery, which is being made by the builders at Paisley. This is the first of three vessels for the Cork Citizens' River Company. Another will shortly be launched. Her length over all is 170 feet, by $18\frac{1}{2}$ feet beam, and she is to be propelled by a pair of oscillating engines of 80-horse power, and fitted with paddle wheels.

The pitch of the screw of the steamship, *Gibraltar*, 101, at Devonport. having been altered from 22 ft. 6 in. to 27 ft. 6 in., a trial of her engines and machinery took place recently, at the measured mile outside Plymouth Breakwater. Captain Astley C. Key, C.B., of the guardship of steam ordinary, Indus, with Commander John E. F. Risk, Mr John Scott, her master, Mr John Ward, assistant-engineer of Keyham Steamyard, and Mr James Steil, inspector of machinery afloat, represented the Admiralty. Mr Mandslay, jun., and Mr Warrener, engineer afloat, were present on the part of the manufacturers of the engines, Messrs Maudslay, Sons, and Field, London. *The Times* of the 21st of March last, contained an elaborate account of the ship and her engines; it will therefore be only necessary now to state that she is pierced for 101 guns, has neither masts, guns, nor stores of any kind on board, and draws 18 ft. forward, and 22 ft. 6 in. aft. The engines are a pair of direct acting. of 400 horse power each, and possess all the modern improvements. With wind easterly, a light breeze, water smooth, and weather fine, she first ran from west to east, 11·841 knots; second, 12·676; third, 12·121; and fourth, 13·284; *maximum* of two runs, 12·7; mean speed of four runs, 12·480; means revolutions, 59; pressure, 20 lb. This result was considered very satisfactory. The ventilation of the engine-room and stokehole was well-maintained. and the vibration of the propeller (Griffith's) was comparatively small. The assistant-engineers of the

Gibraltar complain, and apparently with much reason, that their mess-room, like those in all other line of battle-ships, is on the orlop deck, and is therefore supplied with only two bulls'-eyes for light and ventilation. When the ship has a list, and frequently at other times at sea, when the weather is rough, the water obstructs the light, and prevents the possibility of opening the scuttles. The mess-room is then unfit for human occupation, and is rendered worse by the necessity of a burning lamp. It is suggested that a portion of the gun-room, or some other cooler place, should be appointed to the use of the assistant-engineers, into which they might retreat after their severe duties in the heated atmosphere of the engine-room and stokehole.

The Resistance Iron Cased Frigate.—Following closely upon the successful launch of the *Black Prince* at Glasgow, we have that of the *Resistance*, from Messrs Westwood and Baillie's yard, at Millwall. The chief dimensions of the *Resistance* are—length extreme, 292 ft.; breadth, 54 ft.; depth from spar deck, 38½ ft.; and tonnage, by builder's measurement, 3,668. We should observe, she was designed and built with a view to being used as a "ram," and therefore, instead of having a concealed obtuse beak, like the *Warrior* and *Black Prince*, the whole outline of her bows exactly resembles the curved line formed by a swan's neck and breast. Thus, the projection of the breast is placed below the water line, and would strike the enemy below the water line also. It is this projecting beak and exceedingly retreating bows which gives the whole vessel a clumsy and unwieldy an appearance in the water. As a specimen of ironwork manufacture she is perfect, and neither the *Black Prince* nor the *Warrior* surpasses her in the care and strength with which the whole frame is put together. Like those vessels, she has no external keel, but an inner kind of girder, which acts as a kelson, and which, from stem to stern, is formed of immense strength. To this are bolted the massive ribs, which are made in joints, with an angle or ledge on the outer side, on which the armour plates, with their teak lining, 22 inches thick, are to rest. The armour only extends a length of 144 feet of her broadside, and thus only 14 guns out of the 32 she is to carry are under cover. In proportion to size and tonnage her armament is greater than the *Warrior's*, though, in proportion also, a smaller number are sheltered by the armour. The orlop deck is of wood, but the main and upper decks are of iron, and all the decks are carried on wrought iron beams of the most powerful description, to which both decks and ribs are riveted together with as much firmness as if the whole were one piece of wrought iron. The armour plates are of the same size and excellence as those which cover the frigates already launched; they are about 16 feet long by 4 broad, and 4½ inches thick. Behind these comes the beams of teak, while the bolts which secure the plates themselves are counter sunk outside, so as to have their heads level with the surface of the plates. On both sides the armour is continued to five feet below the water line. The stem and stern, which are unprotected by armour, are crossed and recrossed in every direction with water-tight compartments of the most solid kind. Those which cut off the stem and stern from the armour-coated portions in the centre are faced with plates to five feet below the water line, backed up with iron ribs and 22 inches of teak,—exactly similar in arrangement to the strongest part of the broadside. The bows, as the place where the whole force of the blow must be received when the *Resistance* is used as a steam ram, are strengthened inside with a perfect network of iron of the most massive kind. Here no less than eight wrought-iron decks stretch back from this portion to the armour plates, in addition to other supports, such as cross-bracings and bulk heads, almost innumerable. Throughout the entire length of the armour coated portion run two wrought-iron bulkheads, one inside the armour on each side. These are termed wings, and serve as main passages of communication. Inside these wings are the coal bunkers; inside these again are the water tanks, and within all the magazines. The engines of the *Resistance* are to be of 600 horse power, and with these it is anticipated that a speed of even 15 knots an hour will be obtained. This certainly appears a rather sanguine estimate for a ship of 600-horse power, of such immense weight, and, above all, such unusually full and heavy bows. If her form is in fault, however, the Admiralty are to blame, for they supplied the model. In point of workmanship, all that could be done has been effected, and a better built ship was never sent afloat.

Steam Shipbuilding on the Clyde.—The Clyde builders have launched during the last few days several large and important steamers. Messrs Blackwood and Gordon have sent out from their yard at Port-Glasgow a screw steamer 116 ft. long, 26 ft. 6 in. beam, and 14 ft. depth of hold, which has received the name of the *Osborne*. The steamer, which is being fitted with a pair of double acting engines of 130 horse power, manufactured by Messrs Blackwood and Gordon, at their engine works at Paisley, has been built for Messrs G. Gibson and Co., of Leith, for the Leith and Rotterdam trade. Messrs Wingate and Co., of Whiteinch, have completed a brig-rigged screw steamer of 300 tons burden and 60-horse power, named the *Swatow*. The vessel, which is intended for the China coasting trade, is to be succeeded by another, which Messrs Wingate have on hand, of 600 tons and 200-horse power. The *Memnon*, a vessel of 1,250 tons, which is to be rigged as a two-masted schooner, has been launched by Messrs Scott and Co., Cartsdyke, Greenock. The *Memnon*, which is 200 ft. long, 32 ft. broad, and 21 ft. 6 in. deep, is to to be engined by the Greenock Foundry Company, and will be fitted with an auxiliary screw. Her owners are Messrs Holt, Lampart, and Co., of Liverpool, and she is intended for the Mediterranean trade. The Greenock Foundry Company are also about to engine a screw steamer of 525 tons, launched by Messrs Steele and Co. Messrs Barclay, Curle, and Cohawl have launched at Stobcross Dockyard a screw steamer 216 ft. long, 26 ft 6 in. broad, and 15 ft. deep, named the *Devina*. She is to be fitted with geared engines of 112-horse power, has been built for the Leith, Hull, and Hamburgh Steam Packet Company, and is intended tor their Leith and Stettin trade. The beautiful steamer *Hibernian*, built for the Montreal Ocean Steamship Company by Messrs W. Denny and Brothers of Dumbarton, will shortly leave Liverpool, where she is now lying, for Montreal. The engines are on Spencer's patent, and are of 400-horse power nominal. They are supplied by Messrs Tulloch and Denny, of Dumbarton, and it is expected that they will be worked with a comparatively small consumption of fuel. The Hibernian made a capital run from the Clyde to the Mersey.

The Warrior.—A party of seamen, 100 in number, dispatched to the Victoria Docks for the purpose of masting the *Warrior*, returned to Woolwich on the 16th ult., and on the following day Mr Jones, master rigger, with a party of 50 men of his department, proceeded from Woolwich to commence rigging. The Warrior's chain cables (2⅜ inch), manufactured by Messrs Lennox & Co., have been tested at Woolwich, and bore the strain of 101 tons, ordered by the Admiralty as the regulated test, well. The remainder of the masts, yards, spars, and other gear for the Warrior, iron steamer, were shipped at Chatham Dockyard, on board one of the government lighters, and towed round to the Victoria Dock, to be put on board that vessel by the shipwrights sent from Woolwich dockyard for that purpsse. The main and foretopmasts are of large size and great strength, each measuring 65 feet in length, and weighing rather more than 3 tons. The mizentopmast measures 50 feet, and its weight is about 2 tons. The fore and mainyards are each as large as the masts of many large ships, each measuring 105 feet in length, and weighing upwards of 6 tons. The length of the mizen yard is 71 feet. The three topsailyards are also of great size and strength, the two largest being each 74 feet long, and weighing about two tons. The whole of the masts, yards, &c., for the Warrior have been constructed of unusual strength under the immediate superintendence of the officials connected with the masting department at Chatham Dockyard. The lower masts of the *Warrior* have all been fixed in their places by means of the Chatham sheer hulk, which was sent to the Victoria Docks for that purpose.

Expenditure on the Birkenhead Dock Works.—At the meeting of the Mersey Docks and Harbour Board, held on the 11th ult., it was stated in a report by the engineers, that the total sums expended on these works, since they came into the hands of the Board, had been £838,962 14s. 3d. up to the present time. It was also stated that the works themselves were being rapidly proceeded with. The piling for the foundation of the south wall of the great low-water basin has been driven for a length of 200 yards, and the masonary of the wall on that side commenced, while a large portion of the north wall of the same basin has been built. A very considerable portion of the hydraulic apparatus for working the sluicing runs has been received, and is in course of being permanently fixed. Of the entrances and sluices, 51,668 cubic yards of masonary have been done, leaving 37,510 yards to be done. Of the north and south walls, 14,641 cubic yards have been built, and 60,794 yards remain to be done. For the coal trade accommodation two of the three hydraulic hoists have been erected, and the third is in course of erection, as well as a large crane capable of lifting 60 tons, on the side of the great float.

Steam Ships in the Royal Navy.—A return to the House of Commons, obtained by Mr Correy, M.P., has been issued of the number of steam line-of-battle ships, iron cased ships, frigates, corvettes, sloops, gun-vessels, and gun-boats, on the 31st of March, 1859, and the 31st of March, 1861; the number building, the aggregate number built, with other particulars. On the 31st March, 1859, there were 387 ships afloat, building and converting; and on the 31st of March last the number was 479. In the period of two years, between the 31st of March, 1859, and the 31st of March, 1861, the number launched was 71; the number converted 13; and the total number added afloat was 84. The number of ships built, represented by 8ths, executed, on new ships, 72 15-16; and the tonnage built, not including tonnage added to converted ships, 108 653. The horse-power of ships afloat on the 31st of March, 1859, was 89,732; and on the 31st of March, 1861, it was 118,203, showing an increase in the two years of 28,471. In March, 1859, the amount paid for engines not delivered was L.40,180; and in March, 1861, the amount was L.232,050.

Cardiff.—On the 12th ult., Mr R. H. Michell successfully launched an iron screw propeller dredging-machine. The boat is of iron, 80 feet long and 27 feet beam, to be worked by two direct-acting engines, collective power 60 horses. It has a ladder on each side, capable of working at a depth of 30 feet of water, with buckets which will contain each 1-5th of cubic yard. All the known improvements calculated to facilitate the operation of dredging are introduced. A screw propeller is attached by which the machine is to be navigated at sea. This machine will doubtless prove of real advantage to many small harbours around our coasts, where obstacles are presented to the shipping or which require deepening, and where an ordinary dredging machine and staff would be too expensive. We understand the machine is to be used for opening an entrance into the Britonferry Floating Dock, which is approaching completion, for which purpose she will be finished with all dispatch.

The Board of Trade Returns—The returns for February show a falling off as large as was anticipated in the declared value of our exports, the reduction being £2,348,222, or 21½ per cent., compared with February, 1860, and £1,240,425, or 11½ per cent. compared with February, 1859. Last year, however, having been Leap Year, about £380,000 must be allowed on that account, which would reduce the present falling off to £1,968,222, or about 18 per cent., instead of 21½. The most adverse figures are under the head of cotton goods and yarns, the total diminution in the shipment of these articles being £1,086,891, or 27 per cent.; the United States having taken only £293,373, which is £238,428 less than in February, 1860, and India only £558,940, which is £472,789 less than at that period. Therefore, of the total falling off of £1,086,891 as much as £711,217 occurred from the contraction in our trade to those two countries, the change as regards India being by far the most important.

Exports.—The exports in the first two months of the present year were £16,718,419 against £20,088,437 in the same period of 1860, showing a decrease of £3,370,018, or 16¾ per cent. The diminution is as follows:—January, £1,021,796; February, £2,348,222. Compared with 1859 there is a falling off of £2,489,147, or 13 per cent.

Glasgow Customs.—The duties received at the Custom-house, Glasgow, during the year ended March 31, 1861, amount to £906,895. 1s. 6d., being the largest revenue ever collected at this port in one year.

Railways in France.—On the 31st December, 1860, France possessed 5778 miles of railway, and 430 miles are set down for completion during the current year.

Paris and Orleans Railway.—The receipts of the Company for the week ending the 18th inst. amount to 1,344,901f. 46c., being an increase of 170,831f. 74c. as compared with the corresponding week of last year. The receipts from the 1st of January to the 18th of March amount to 13,747,675f. 75c., being an increase of 1,915,827f. 29c. as compared with the corresponding period of the year 1860.

Gas Consumption in Paris—There appears to have been a very rapid increase of late years in the consumption of Gas in Paris. At the general annual meeting last week of the "Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz," the report presented stated that the consumption had been in 1855, 33,000,000 cubic metres; in 1856, 44,079,000 cubic metres; in 1857, 52,261,000 cubic metres; in 1858, 57,920,000 cubic metres; in 1859, 63,015,000 cubic metres; and in 1860, 70,348,600 cubic metres. The profits of the company in 1860 were L.332,200, and the dividends paid during the year were 70f. per share as compared with 60f. per share in 1859.

Railway Traffic.—The traffic returns of railways in the United Kingdom for the week ending the 30th March, amounted to £513,470, and for the corresponding week of last year to £476,870, showing an increase of £36,600. The gross receipts of the eight railways having their termini in the metropolis, amounted to £222,395. and for the corresponding week of 1860 to £202,955, showing an increase of £19,440. The receipts on the other lines in the United Kingdom amounted to £291,075, and for the corresponding week of last year to £273,915, showing an increase of £17,160, which, added to the increase on the metropolitan lines, leaves the total increase £36,600, as compared with the corresponding week of 1860.

West Midland Railway.—The total traffic receipts of this company for the fortnight ending the 24th of March amounted to £13,238, and for the corresponding fortnight of 1860, to £12,879. The expenditure amounted to £6,408, or at the rate of 48·40 per cent., while the expenses for the corresponding fortnight of 1860 amounted to £5,516, or at the rate of 42·83 per cent. The aggregate receipts for the first five fortnights and 13 days of the half-year amounted to £74,207, as against £75,083, for the corresponding six fortnights and one day of the previous year. And the aggregate expenses for the first five fortnights and 13 days of the half-year amounted to L.39,607, being at the rate of 51·30 per cent. as against L.34,022, for the corresponding six fortnights and one day of the previous year, or at the rate of 45·31 per cent.

On the Solvent Properties of Bichloride of Tin.—Mr Girardin has lately presented a memoir to the Academy of Sciences, in which he states that bichloride of tin dissolves certain substances when submitted to its action in a manner analogous, though feebler in degree than that possessed by the bisulphide of carbon. At its boiling point, bichloride of tin dissolves considerable quantities of octohedral sulphur, of iodine, and of ordinary phosphorus; solutions of which, on being allowed to cool, deposit the sulphur and the iodine in very beautiful crystals. The phosphorus is at first deposited in a liquid state, but it subsequently solidifies into an amorphous mass. Amorphous sulphur is also dissolved by a solution of bichloride of tin after a prolonged boiling, and the crystals which separate on cooling are octahedral. Red phosphorus is perfectly insoluble in this agent; but bromium and the bisulphide of carbon are dissolved by it in all proportions—silicium, tellurium arsenic, antimony, bismuth, tin, and metallic oxides and chlorides are insoluble in bichloride of tin.

The Coal Trade.—The total quantity of coal and coke exported from the various coal ports of the United Kingdom during the month of March was, of coal, 498,170 tons, and of coke, 20,570 tons. Of this quantity, which shows a considerable increase when compared with the returns for the preceding month, Newcastle-on-Tyne exported 133,930 tons of coal, and 12,366 tons of coke: Shields, 6128 tons of coal, and 112 tons of coke; Blyth, 16,226 tons of coal; Sunderland, 77,395 tons of coal, and 3038 tons of coke; Seaham, 2912 tons of coal; Hartlepool and West Hartlepool, 41,918 tons of coal, and 2262 tons of coke; Middlesborough, 9742 tons of coal, and 1913 tons of coke; Hull, 13,916 tons of coal, and 120 tons of coke; Goole, 1126 tons of coal; Maryport, 585 tons of coal; Liverpool, 5059 tons of coal; Cardiff, 72,673 tons of coal, and 88 tons of coke; Newport, 10,273 tons of coal; Greenock, 6266 tons of coal; Grangemouth, 3773 tons of coal; Swansea, 27,795 tons of coal, and 220 tons of coke; Alloa, 3481 tons of coal; Charlestown, 2689 tons of coal; Llanelly, 4349 tons of coal, and 270 tons of coke; Inverkeithing, 454 tons of coal; Ayr, 309 tons of coal; Glasgow, 6175 tons of coal, and 165 tons of coke; St David's, 3471 tons of coal; Borrowstonness, 1228 tons of coal, and 16 tons of coke. The quantity of coal, coke, and culm shipped during the month to different ports in the United Kingdom was, of coal, 788,172 tons; of coke, 3797 tons; and of culm, 4982 tons. Of this quantity, which is larger than that shipped during February, Newcastle shipped 165,265 tons of coal, and 801 tons of coke; Shields, 943 tons of coal; Blyth, 9187 tons of coal; Sunderland, 136,795 tons of coal, and 271 tons of coke; Seaham, 58,062 tons of coal; Hartlepool and West Hartlepool, 107,721 tons of coal, and 587 tons of coke; Middlesborough, 15,241 tons of coal, and 240 tons of coke; Goole, 6933 tons of coal; Swansea, 13,797 tons of coal, and 4982 tons of culm; Borrowstonness, 3197 tons of coal; Maryport, 25,679 tons of coal, and 100 tons of coke; Llanelly, 16,620 tons of coal; Charlestown, 3912 tons of coal; Cardiff, 59,236 tons of coal, and 1025 tons of coke; Inverkeithing, 272 tons of coal; Ayr, 6726 tons of coal; Newport, 145,114 tons of coal, and 746 tons of coke; St David's, 69 tons of coal; Alloa, 600 tons of coal; and Whitehaven, 12,803 tons of coal, and 27 tons of coke. During the month there were 5555 vessels of different nations engaged in the coal trade, of which number 3773 were employed in the home, and 1782 in the foreign coal trade.

Tunnel through Mont Cenis.—The tunnel from Bardonnèche on the Italian side to Modanc on the Arve, passing through the chain of Alps a little south of Mont Cenis, will be about 7½ English miles in length. The Sardinian Government has undertaken its construction, and has obtained an annual grant of eight millions of francs for the purpose. In order to supply the workmen with fresh air, which would be impossible by the ordinary method of shafts from above, boring machines have been invented which are set to work by air. compressed by hydraulic power. The process of excavation is thus hastened, and the labourers have a plentiful current of fresh air. It is only lately that these machines have been set to work, and little progress has been made, but their operation is asserted to be satisfactory. An earlier commencement would have been made had not delay been occasioned by the giving way of two of the compressed air-pipes during a preliminary trial. A piece connected with one of the water pipes and the valve of one of the air compressors were also broken. Two months were occupied in providing a remedy for what proved to be a defective system of valves. Previously to the application of the new means of excavation there had been completed at the Italian end of the tunnel 528 metres, and 193 metres had also been partially bored. On the French side 511 metres had been completed, and about 23 metres more had been partly excavated. That is less than a twelfth of the entire work had been finished. Some people prognosticate that much difficulty will arise from the influx of water penetrating through fisures from the heights above where there are several lakes. It is, however, to be hoped that the skill of the engineers will triumph over all the obstacles, and that in the course of time this, the most gigantic of tunnels, will be traversed by railway carriages.

The Crystal Palace.—We are glad to see that the Directors have made arrangements for a highly attractive season, and that unusual exertions have been made in catering for the public amusement and instruction. The Gardens and Plants in the interior of the Palace are, for the time of year, in an unusually forward state, and give evidence of an early spring. The Fine Arts' Courts and the various other objects of attraction, have been entirely put in order for the coming season. The Exhibitors' Department—one of the most important in the establishment—is daily receiving considerable additions. The proximity of the International Exhibition of 1862 is already telling most favourably upon this important branch of the Company's revenue, it being clearly foreseen that, during such a period, the demand for space at the Crystal Palace will be far beyond what can be allotted; while the resident population so rapidly rising up all around it, of itself ensures a large amount of custom to the Exhibitors. This is beginning to make itself felt by the offers lately received from eligible tenants for two of the large Courts. The works of the Farringdon Street Extension of the London, Chatham, and Dover railway, are in active operation only a few hundred feet from the northern end of the Palace, while the bridge over the Thames connecting Wandsworth and Kensington, and, *par consequence*, the whole of the Northern and Western lines direct with the Palace are in full progress, and no doubt is entertained but that they will be finished by this time next year. The new season at the Palace opens on the 1st inst., by a grand performance of the Creation, similar to that of Elijah last year, by the Sacred Harmonic Society, under the direction of Mr Costa.

On the Employment of Electricity in the Rearing of Silkworms.—Under the above title, Monsieur Sauvageon, of Valence, recently presented to the French Academy des Sciences a very interesting paper on a novel application of electricity. He observes that being resident in a large silkworm district where for several years past the rearing of these insects had proved almost a failure, the idea occurred to him that electricity might be successfully employed as a means of counteracting the epidemic by which they were attacked. The result of his experiments was most satisfactory. His mode of proceeding was as follows:—

He obtained from a silkworm breeder 53 silkworms in the caterpillar state, taken promiscuously from several thousands, and he continued to rear them in the usual manner.

These caterpillars had then just completed their second age, and from their appearance a fair yield of silk was anticipated. He bestowed on them all due care and attention until they had completed their third age. As they were somewhat tardy in arriving at this stage, and appeared to be affected with langour and inappetency, Monsieur Sauvageon thought that this was the most opportune period for commencing his experiments with electricity. He accordingly procured an oblong plate of sheet iron, in each corner of which he made a small hole. This was then placed in two insulators (two glass tumblers), and two very small pairs of a Bunsen battery were connected in such a manner that a communication was established. The elements were then placed in small boxes admitting only exit of the conductors, in order that the silkworms might not be affected by the deleterious emanations arising from the battery.

The silkworms, after having completed their third age. were placed on the plate which had been previously strewed with mulberry leaves. The moment the silkworms were affected by the electric current they manifested symptoms of anxiety and uneasiness, and endeavoured to escape from its influence by diminishing their number of points of contact with the plate as much as lay in their power, which they effected by supporting themselves on two feet only. After about two minutes the electric communication was interrupted, and the silkworms replaced on their usual shelf; and on being supplied with fresh leaves, they immediately commenced feeding.

The electric current was applied daily to such of the silkworms as were not casting their fourth skins, but no increase was made in its strength or in its duration. The result was that 53 very beautiful cocoons were obtained, whereas the silkworms from which Monsieur Sauvageon took his subjects promiscuously had not completed their fourth age; and from their general appearance, it was feared they would not produce altogether as many cocoons as had been obtained from those which had been subjected to this novel mode of treatment.

PETROLEUM, OR ROCK OIL.—Recent advices from Canada mention the discovery of large quantities of petroleum, in the western counties of Canada. The largest amounts have been found in the township of Enniskillen, in the county of Lambton, where it is said to ooze up to the surface in large quantities and of superior quality, admirably adapted for illuminating and lubricating purposes. When sunk to the depth of some twenty to thirty feet, these wells yield from 10 to 150 barrels every twenty-four hours. In other places they have to sink wells to the depth of 100 to 150 feet. Geologists are not quite satisfied as to the mode of its production, or the extent of country in which it may be found. In Enniskillen there is first a superincumbent layer of earth, about 100 feet in thickness; then there is a layer of limestone rock, which appears to be about fifty feet thick; and under this the shale which contains the oil. It is not thought that these shales have given rise to the oil, but that it has probably been derived from the underlying limestones, which are peculiarly rich in fossil remains. Petroleum occurs, though in small quantities, in most of the silurian rocks of Canada, in localities where it can have no possible connection with beds of bituminous shale. The crude oil sold at 14 cents per gallon, which was much below its actual value. It has risen considerably, however, buyers having gone from New York, Boston, &c.

THE ALPACAS IN AUSTRALIA.—Those who take an interest in the development of this enterprise will learn with satisfaction that, although Mr Ledger has not yet received his proper recompense from the community likely to be directly benefited by his exertions, the animals are fulfilling all the expectations that have been formed respecting them, both as to their condition and their increase. Upon their arrival at Arthursleigh a little more than a year ago the flock numbered 256, several losses having taken place from the want of sufficient food at Liverpool, the animals being generally in a poor condition. From various causes about 30 have died at Arthursleigh; a large number of these were the oldest llamas and alpacas, and their deaths were no doubt traceable to the effects of exposure during the long journey in South America and upon the voyage. These losses have, however, been far more than retrieved by the births, which have already brought up the number of the flock to 352. The lambing is now going on; we learn that hitherto it has been extraordinary successful, and that before it is completed the flock will probably number nearly 380 animals. Having abundant pasturage and room to ramble, and being also now pretty well acclimatized, they are fast regaining their natural condition, giving full proof of the adaptation of the climate and the herbage to their healthy propagation. We understand that, among other products which it is intended to forward to the Great Exhibition in London in 1862, there will be not only samples of Australian alpaca wool, but some stuffed alpacas, llamas, and vicunas: and considering the importance that is attached by the English merchants and manufacturers to this new branch of our productive industry, there is no doubt that these articles will be examined with much interest.

HEALTH OF SCOTTISH TOWNS.—The Registrar-General reports that the deaths in the eight principal towns of Scotland in January last—2,779—greatly exceeded those of any January since the Registration Act came into operation in 1855. This is partly to be attributed to the prevalence of small-pox, scarlatina, and diphtheria, and partly to the severity of the weather at the close of the last year and the opening of this, though Scotland has again been better off in this respect than might have been expected from its high latitude. Indeed, at Aberdeen the thermometer never fell below 19 deg. in January, while at the Royal Observatory, Greenwich, nearly six degrees further south, it was at 16 deg.; at Paisley, however, it marked 8 deg., and at Perth 10 deg. The deaths in the eight towns in the year 1860 (26,028) were in the high proportion of 286 in every 15,000 of the estimated population, It would be understating the facts to say that for every four persons who died in London last year five died in the Scottish towns; it would be nearer the truth, and a very little way from it, to state that for every three deaths in the metropolis there were four in the Scottish towns. In Glasgow half the deaths in the year were of children under five years of age. The mortality was heaviest in Glasgow and Greenock. In Edinburgh it was but 229 in the 10,000, and the Registrar-General notices the advantage that city possesses in its exposed site on sloping hills, and the consequent thorough ventilation of even its most densely peopled low streets and closes; were its drainage, surface as well as underground, and its sanitary arrangements in the lowest class of dwellings somewhat improved, and overcrowding prevented, he has no doubt that it would prove one of the very healthiest towns of the kingdom.

SAVINGS BANKS IN THE RAILWAY SERVICE.—The first annual meeting was recently held at Manchester of the depositors in a provident savings bank in connection with the Manchester, Sheffield, and Lincolnshire Railway Company. The system adopted has the advantage of bringing the bank home, as it were. to each depositor, the rule being that any servant of the company may direct such amount as he thinks proper to be regularly deducted from his salary or wages, and entered on the fortnightly pay-bills, and placed in the bank. The report of the secretary, Mr J. Rawlinson, states that the position of the bank is highly satisfactory. There have been during the year 375 accounts opened, 8 closed and renewed, and 84 closed. The amount of deposits has been £2,060, in 5,139 sums; the repayments have amounted to £400; and the sum due to depositors on the 20th of January, including interest, was £1,689. Mr Chapman, the Chairman of the railway company, presided at the meeting, and in moving the adoption of the report expressed his pleasure at the circumstance that the largest number of depositors were those who had not sums exceeding 5s. invested, these being 3,483 out of the 5,139 deposits. It showed that those who had very little to spare were trying to save it, and entering on the path of frugality.

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

Recorded October 29, 1860.

2646. Alexander S. Stocker, Wolverhampton, Staffordshire—Improvements in the manufacture of horse and other shoes, and in the machinery or apparatus to be employed therein, part of which improvements are also applicable to metal boot heels and various other articles.

Recorded December 17.

3090. John G. Taylor, Paris—Improvements in dress and other fastenings, and in the application and manufacture thereof.
3100. John G. Taylor, Paris—Improvements in the manufacture of boots and shoes, and in the method of measuring the human foot for fitting the same.

Recorded January 2.

7. Daniel A. Johnson, Chelsea, Suffolk, Massachusetts, U.S.—Improved method of constructing wooden wheels.—(Communication from F. M. Gibson, Chelsea, U.S.)

Recorded January 5.

37. John I. Grylls, Murton Street, Sunderland—Improvements in anchors.
38. John Roberts, Upnor, Kent—An improved warming hassock or footstool.

Recorded January 9.

54. James Fitton, Cavendish, and F. E. Fullerton, Chester, Windsor, Vermont, U S.—Separating foreign matters from the droppings from carding machines and for returning the residue thereunto.
55. Joseph Boulton and John C. Boulton, Shoreditch—The feeding of a machine for folding of envelopes, and likewise for laying down the lappets previous to the second descent of the plunger.

Recorded January 10.

60. Joseph A. Munn, Earl Street, Red Lion Square—A spring window supporter.—(Communication from John Rogers, Deep River, Connecticut, U.S.)

Recorded January 11.

78. Marie C. E. Page, Valdoie, near Belfort, France—A mechanical kneading machine.

Recorded January 12.

92. Honourable W. E. F. Maurice, Hyde Park Gate—Improvements in generating heat for locomotive, marine, and other boilers and furnaces.
96. Marie V Boquet, Rue de Rivoli, Paris—An improved mode of stoppering or closing canisters, bottles, or other vessels.

Recorded January 14.

99. Crane Brush, Enfield, Meath, Ireland—Improvements in fog-signals for railways.

Recorded January 15.

112. Charles Stevens, Charing Cross—A new paste made from wood, to be used in the manufacture of various articles, together with the apparatus employed in the preparation of the same.—(Communication from Mr Loyer, Rue Laffitte, Paris.)

Recorded January 19.

156. William Clark, Chancery Lane—Improvements in compass contractors.—(Communication from Charles B. Wood, New York, U.S.)

Recorded January 21.

158. Francis W. Perrott, Hanover Street, Walworth—A lubricating grease or paste for railway wheels and all kinds of machinery.
166. Jean B. Pascal, Lyons, Boulevart St. Martin, Paris—Improvements in generating burning gases to be applied as a motive power, and in apparatus for the same.

Recorded January 29.

232. John Robertson, Upper Newington, Mount Pleasant, Liverpool, Lancashire—An improvement or improvements in sewing machines
236. William Smyth and Matthew Wasley, Coed Mawe Pool Mine—Improvements in the mechanism or apparatus for crushing or breaking up ores, stones, and other hard stones.

Recorded February 2.

284. William Clark, Chancery Lane—Improvements in instruments for testing the alcoholic strengths of liquids —(Communication from Marie E. E. B. Vidal and Alexandre A. N. Patte, Boulevart St. Martin, Paris.)

Recorded February 5.

296. Richard Jeffery, Guildford, Surrey—An improved tumbler lever and body, applicable to double and single breech loading guns.
298. William Paton, Johnstone, Renfrewshire—Improvements in coating, colouring, and glazing, or finishing laces, bands, straps, belts, and other similar articles, and in the machinery or apparatus employed therein.

Recorded February 6.

306. Thomas Gee, Nottingham—The manufacturing of articles of utility from materials which were previously of no value whatever, and for ornamenting the same.

Recorded February 9.

331. James Higgins and Thomas S. Whitworth, Salford, Lancashire—Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.
332. John Lockwood, Dudley Hill, Bradford, Yorkshire—Improvements in healds for fibrous materials, and in machinery for making the same
333. Charles White, Pontypridd, Glamorgan—Improved rolling machinery for rolling iron and other metals.
334. Josiah G. Jennings, Holland Street, Blackfriars, Surrey—Improvements in capsules, or covers for the necks or ends of jars, bottles, and other vessels, and hollow tubes or bodies.
335. Augustus Seidemann and Theodore Lange, Newcastle-upon-Tyne—The manufacture of sub or oxi-sulphate of lead.—(Communication from Ludwig Brumlen, New York.)

Recorded February 11.

336. Henry Loach, Love Lane, Shadwell—Improvements in the manufacture or spinning of yarns or threads from hemp, flax, cotton, or other fibrous materials, and in the apparatus employed therein.
337. Eugene Gervaise and Joseph E. Bernier, Paris—Improvements in the manufacture of artificial leather, or a substitute for leather.
338. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the heating and cooling surfaces of engines propelled by aeriform fluids.—(Communication from Auguste C. Lehot, Valognes.)
339. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the construction of steam generators, employed for heating, drying, evaporating, and other purposes.—(Communication from Julien Fradet, Paris.)
340. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the construction of certain kinds of breech-loading fire-arms.—(Communication from Charles J. Ferdinand, France.)
341. William E. Newton, Chancery Lane—Improvements in floating structures.—(Communication from Thomas Schofield and Robert Schofield, Grass Valley, Nevada, California, U S.)
342. William E. Newton, Chancery Lane—Improvements in machinery for preparing hemp and similar fibrous materials.—(Communication from Joseph C Todd and Phillip Rafferty, Paterson, Passaic, New Jersey, U.S.)
343. William S T. Clarke, Charing Cross—A railway break.
344. Henry Baker, Glasgow, Lanarkshire—Improvements in the manufacture of lucifer matches.
345 John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the construction and arrangement of bearings and grease boxes for shafts and axles, applicable also to the bosses of wheels.—(Communication from Jose Gallegos, Paris.)
346. Nathan Thompson, Abbey Garden, St John's Wood—Improvements in machinery for preparing wood for boat-building and other uses.
347. Richard A. Brooman, Fleet Street—Treating the tobacco plant in order to manufacture paper.—(Communication from Michel, Chominot and Picard, Marseilles.)
348. Richard A. Brooman, Fleet Street—An improved gas apparatus, intended chiefly for lighting pipes, cigars, and cigarettes.—(Communication from Pierre Duchamp, Lyons, France.)
349. Giovanni G. Aggio, Nevill's Court—Improvements in stereotype plates, and in machinery or apparatus for manufacturing the same.

Recorded February 12.

350. Sidney Frankau, Bishopgate Street—A cigar or pipe rack, which is also applicable for other purposes.
351. William Oldfield, Noble Street, St Luke's—Improvements in writing and dressing cases.
352 Nathan Frankenstein, Mincing Lane—Improvements in syphons for drawing off liquids from casks and other vessels.—(Communication from Henri Cazades Rue Barreyre, Bordeaux.)
353 Alexander Parkes, Birmingham, Warwickshire—Improvements in electric telegraph conductors.
354. James Bowron, Stockton-on-Tees—Improvements in the manufacture of bottles and other vessels of glass.
355. Alexander Parkes, Birmingham, Warwickshire—Improvements in the manufacture of the fire boxes of locomotive and other tubular boilers.
356. William Corbett, Clayton, near Manchester, Lancashire—Improvements in the arrangement and construction of puddling and heating furnaces employed in the manufacture of iron and steel.
357. Charles Prater, Charing Cross—Improvements in slings or straps adapted for knapsacks, wallets, game bags, and other such like uses.
358. William Maltby, De Crespigny Park, Camberwell—Improvements in the process of manufacturing a glutinous or viscous substance to be used in dressing textile fabrics, and for other such like processes, or in brewing and distilling, and also in the apparatus to be used for the same and similar purposes.
359. William E Newton, Chancery Lane—Improvements in projectiles for ordnance and fire-arms.—(Communication from Silas T. Burbanks, Providence, Rhode Island, U.S.)

Recorded February 13.

360. William Brown, Edgar Place, James Street, Mile End, Middlesex—Improvements in the manufacture of frames, suitable for containing photographic and other portraits and pictures.
361. Eden T. Jones, Morden College, Blackheath, Kent—The suppression of arsenical and sulphurous fumes emitted during the first operation or calcination of copper ores.
362. Adolph Ellissen, Moorgate Street—Improved apparatus for working the breaks of railway trains.
363. Ellis Butterworth, Calder Cottage, Rochdale, Lancashire—Improvements in machinery for spining and doubling cotton and other fibrous substances.
364. Charles F. Atkinson, Sheffield, Yorkshire—The application of steel to the manufacture of collars and wristbands to be worn as articles of clothing.
365. Charles S Roskilly Falmouth, Cornwall—Improvements in refining malt liquors.
366. Edward Cradock, High Holborn—Improved mechanism for improving the draught in open fire-places, the same apparatus being applicable to deadening or extinguishing fires in such fire-places.
367. William Clark, Chancery Lane—Improvements in sewing and embroidering machines.—(Communication from Louis A. Maureau, Boulevart St Martin, Paris.)
368 Thomas T. Lawden and Thomas Jones, Birmingham, Warwick—Certain improvements in breech-loading fire arms.
369. Charles A. Lawson, John B. Barnes, and John Loach, Aston, New Town, Birmingham, Warwickshire—Certain improvements in projectiles applicable to the use of ordnance and small arms.
370. Joseph S Blake, Portsea, Hants, George C. Lingham, and Joseph Nickling, Birmingham, Warwickshire—Certain improvements in the means of holding or filing receipts, invoices and other papers or tickets, and which said means are also applicable for holding other articles, such as fancy or other wares required to be held.
371 Michael Henry, Fleet Street—Improvements in the construction of a certain description of castor, and in apparatus for manufacturing certain parts of such castors, which apparatus may also be applied for producing rounded bodies for other purposes.—(Communication from Jean B. G. Clergeau, Boulevart St Martin, France.)
372. William Roberts, Milwall, Poplar—Improvements in portable or fire pumps, and apparatus connected therewith.
373 John Poole, James Wright, Frederick S. Hemming, George Searby, Moorgate Street—Improvements in drilling, boring, or excavating rock or other earthy substances.
374. Abraham Ripley, Bridge Street, Blackfriars, and William H Stevenson, Duke Street, Adelphi—Improvements in the method of manufacturing and in the mode of constructing and forming pistons and piston-rods.

Recorded February 14.

375. George Searby, Threadneedle Street—An improved steam gauge.
376. Thomas Cobley, Meerholz, Hesse, Germany—Improvements in the manufacture of white lead, zinc, white and glazing or potter's lead.
377. Patrick S. Devlan, Elizabeth Port, Union, New Jersey, U.S.—A new and useful bearing surface for all kinds of journal and axle boxes.
378. Eugene Rimmel, Strand—A new process for impregnating the atmosphere with perfuming or purifying vapours.
379. James Garforth, Dukinfield, Cheshire—Certain improvements in metallic pistons.
380. Henry D. P. Cunningham, Bury—Improvements in sails and in the rig of ships and vessels.

Recorded February 15.

381. Jean B. H. F. C. Nicolet, Brussels, Belgium—A new system of ornamenting skin gloves.
382. Ebenezer Poulson, Strathmore Terrace Shadwell—Propelling all kinds of land carriages, river and canal barges, and boats.
383. Moses A. Prenslau, Liverpool, Lancashire—Improved preparations for the cure and prevention of toothache, and the preservation ot teeth.
384. George J. Wainwright, Charles T. Bradbury, and John Lawton, Dukinfield, Cheshire—Improvements in machinery or apparatus for roving, slubbing, or spinning cotton and other fibrous materials.
385. William H. Mansbridge, Camden Lodge, St. Paul's Road, Camden Town—Improvements in railway brakes.
386. Adolphe Lecat, Crevecœur, France—Improvements in looms for weaving.—(Communication from Francois Postel, Oise, France.)
387. Allen Senior, Dumfries—Improvements in looms for weaving.
388. Marcus B. Westhead, Manchester, Lancashire—Improvements applicable to the government or regulation and registration of excessive speed in hoisting apparatus and railway carriages.

Recorded February 16.

389. John Braham, Bristol—Improvements in spectacles and band frames.
390. James Walker, Rhodes, Manchester—Improvements in the manufacture of soles for clogs and other coverings for the feet, and in the machinery employed therein.
391. Ernest H. Barre, and Charles M. J. Blondel, Nantes, France—The manufacture of paper from a pulp obtained from wood, and all other vegetable produce of a woody nature, by means of the isolation of the cellular fibres.
392. James Horn, Whitechapel, High Street—Improvements in machinery or apparatus for the manufacture of bituminized paper pipes, and other similar articles.
393. Louis H. Real, Paris—Improvements in weaving.
394. Thomas Settle, Bolton, Lancashire—A certain improvement in machinery or apparatus employed in preparing cotton, wool, flax, and other fibrous substances for spinning.
395. Nicholas Nussey, Holbeck, Leeds, Yorkshire—Improvements in machinery for preparing and combing wool, silk, cotton, flax, or other fibrous substances.

Recorded February 18.

396. Joshua Womersley, Norwich—Improvements in paper making machines.
397. Robert Offord, junior, Wells Street, Oxford Street—Improvements in the adaptation of india rubber, and the compounds thereof to various parts of public and private carriages or vehicles.
398. Frederick Schäfer, Golden Square—An improvement in travelling bags and in frames for the same.
399. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in sewing machines—(Communication from the Grover and Baker Sewing Machine Co., New York, U S.)
400. Edmund F. Barnes, New York U.S.—Improvements in instruments or a combination of conductors and attachments for transmitting and recording messages in any form of letter or character by means of electricity or electro magnetism acting either mechanically or chemically, and which invention may also be applied to the transmitting or copying figures as maps of any form of outline.
401. Cyrus Price, Wolverhampton, and Elihu Price, Berry Barr, Staffordshire—Improvements in locks and latches.

Recorded February 19.

402. Alfred Carter, Langley Place, East India Road—An improved stadium or telemetere.
403. James B. Hawkins, North Street, Limehouse—Improvements in the construction of cocks for drawing off liquids and vapours, and for regulating the flow or passage thereof.
404. John Browning, Minories—Improvements in telescopes and in covers for the object glasses thereof.
405. John H. Brierley, Stannary Works, Halifax, and Aldermanbury—A clasp, or fastener for belts, bands, or straps, or for improvements contained therein.
406. Thomas Pedrick, Brighton Terrace, Brixton, Surrey—Improvements in obtaining and applying motive power by water, and in apparatus connected therewith.
407. Matthew Paris, Hill Side, Wimbledon, Surrey—Improvements in fire-arms.
408. William Clark, Chancery Lane—Improvements in the preparation of alkaline and earthy cyanides.—(Communication from Louis J. F. Margueritte, and Alfred Lalouël de Sourdeval, Paris.)
409. William Pilding, Borough Road, Southwark, Surrey—Improvements in envelopes and letters and in the mode of securing them, also in the seals or seal impressions or wafers used for such purposes.
410. Alfred V. Newton, Chancery Lane—An improved mode o[illegible]pling the rails of railways.—(Communication from Joseph M. Heard, Prairie Station, Mouroe, Mississippi, U.S.)
411. John L. Jullion, Tynemouth, Northumberland—Improvements in the construction of the bearings and other rubbing surfaces of machinery.—(Communication from S. M. Saunders, New York.)
412. William E. Newton, Chancery Lane—Improvements in the construction of guns, and in loading and firing the same.—(Communication from William M'Cord, Charles F. Cox, and Robert Woodward, New York, U S.)
413 Richard B. Burchell, Brooklyn, New York, U.S.—An improvement in tighteners for the cords of curtains.
414. Archibald Turner, Leicester—Improvements in preparing warps for the manufacture of elastic fabrics.
415. Michael Henry, Fleet Street—Improvements in furnaces.—(Communication from Jean G. C. Teubrinck, Boulevart St Martin, Paris.)

Recorded February 20.

416. Benjamin Nicoll, Regent Circus, Piccadilly—An improved method of treating needles used in sewing and other machines, applicable also to those parts of such machines that hold the needles, and applicable to all other descriptions of needles, and to scissors and to thimbles treated in like manner.

417. Edward Wilkins, Bath Terrace, Camberwell New Road, Surrey—Improvements in the manufacture of boots, shoes, and goloshes, or other coverings for the feet, and in lasts or blocks for facilitating such manufacture.
418. Charles Smith, Manchester, Lancashire—Improvements in machinery or apparatus for cutting or shaping soap or other similar materials.
419. Josiah Vavasseur, Gravel Lane, Southwark, Surrey—Improvements in steam generators or boilers.
420. Thomas Holstead, Botchergate, Carlisle, Cumberland—Improvements in the manufacture of certain articles of confectionary and biscuits and other articles from plastic substances.
421. James Sutton, Sheffield, Yorkshire—An improvement in the frames of spectacles.
422. George Parsons, Martock, Somerset—Improvements in the construction of wheels.
423. William Halse, Love Lane—An improved construction of reel for velvet or other ribbons.
424. Thomas Richardson, Newcastle-upon-Tyne—Improvements in the manufacture of manure.

Recorded February 21.

425. John Louch, Fenchurch Street—Improvements in furnaces.
426. Frederick D. Blyth, Fenchurch Street, and James Adair, Crane Court, Fleet Street—Improvements in machinery for forging nails and other articles.—(Communication from John Hood, New York, U.S.)
427. Charles Maschwitz, younger, Birmingham, Warwickshire—A new or improved tap or stop cock for liquids, steam, and gas.—(Communication from Joseph Berger, Biala, Austrian Galicia.)
428. Jules Dutilleul, Paris, Rue Saint Martin—A rotative whistle of alarm, applicable to steam boilers, indicating the level of the water.
429. James Moon, Bedford Row—Improvements in means or apparatus for closing the passages of the chimneys from stoves and other fire places.
430. James J. Miller, younger, Clarendon Place, Vassall Road, Brixton, Surrey—Improvements in apparatus for governing or regulating the speed of steam and other engines and machines.
431. John Longshaw, Manchester, Lancashire—An improved method of applying breaks to the wheels of railway and other carriages.
432. William E. Newton, Chancery Lane—Improvements in centrifugal governors for marine and other steam engines and other motors.—(Communication from Charles T. Porter, New York.)
433. William E. Newton, Chancery Lane—Improvements in breaks applicable to railway carriages.—(Communication from Augustin Castellvi, Saragossa, Spain.)
434. Joshua J. Watts and Samuel Harton, Shoe Lane—Improvements in the manufacture of music plates.
435. Daniel Evans, Stratford, Essex—Improvements in the manufacture of railway and other wheels.
436. William Watson and Alexander Watson, Whitehaven, Cumberland—Improvements in machinery or apparatus for casting bullets.
437. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—The application of certain vegetable substances to the manufacture of paper pulp, and the mode of treating the same for that purpose.—(Communication from Charles M. Gaguage, Paris.)
438. Herbert P. Ribton, Dublin—Improvements in safety apparatus for lighting mines.

Recorded February 22.

439. Benoit Lang, Skinner Street, Snow Hill—Improvements in apparatus for feeding infants and invalids.
440. Austin Crookes and Henry Roberts, Sheffield, Yorkshire—An improvement in Doctor's calico webs or scrapers. used in the process of printing calicoes, muslins, and other textile fabrics.
441. Arthur L. Cole, Pall Mall—Improvements in fire arms.
442. James B. Mannix, Torriano Grove, Kentish Town—An improved method of applying springs to railway and other carriages.
443. Henry G. Prossor, Waterford—Improvements in the mode of and apparatus for singeing the hairs from off the carcasses of pigs.
444. Henry G. Prossor, Waterford—Improved apparatus to be used on the decks of ships for the purpose of separating chaff, straw, sand, or other foreign substances from corn or other grain when it is being deposited in their holds for shipment.
445. Henry Hatchwell, Newton Abbot, Devonshire, and Samuel B, Hatchwell—An improvement in stools or seats.
446. Edwin T. Truman, Old Burlington Street—Improvements in masticators or machines employed in the mastication of gutta percha, india rubber, and other similar substances.
447. Manuel L. J. Lavater, Guildford Street, York Road, Lambeth, Surrey—Improvements in the manufacture of pouches of india rubber and india rubber fabrics.
448. Albert Horwood, Great Quebec Street, New Road, Marylebone—Improvements in the application of electricity for communicating by signals with carriages in motion on railways.
449. John Reeves, New York, U.S.—Improvements in electro-magnetic engines for obtaining and applying motive power.
450. William Walker, Liverpool, Lancashire—Improvements in rocket guns and rocket harpoons and appendages to be used therewith.—(Communication from Thomas W. Roys, Paterson, New Jersey, U.S.)
451. Charles Eyland, Walsall, Staffordshire—Improvements in the manufacture of certain kinds of spectacle frames.
452. Robert Cuthbert and William Cuthbert, Newton-le-Willows, near Bedale and Leeming, Yorkshire—Improvements in reaping machines and grass mowing machines.
453. Andrew Barclay, Kilmarnock, Ayrshire—Improvements in pumping engines.
454. James E. Cook, Greenock, Renfrewshire—Improvements in coating and protecting the silvered surfaces of looking-glasses or mirrors.
455. Robert Mushet, Coleford, Gloucestershire—An improvement or improvements in the manufacture of cast steel.

Recorded February 23.

456. James Martin, Church Row, Limehouse—Improvements in the preparation of red dyes.
457. Charles Stevens, Charing Cross—An improved method of unhooking in Jacquard machines.—(Communication from Stefano Pettaluga, Rue Laffitte, Paris.)
458. Charles Stevens, Charing Cross—An improved elastic horse collar.—(Communication from Amedee Beaujouan, Rue Laffitte, Paris.)
459. Armand L. A. Heihelot, Paris—Machinery for reducing wood into chips or shavings.
460. Hugh Mackenzie, Ardross and Dundonnell, Ross-shire—Improved means of applying the water of rivers for driving mills without weirs or other obstruction to the passage of salmon and other fish.
461. John W. Wyatt, Bunhill Row, Finsbury—Improvements in coating or covering metallic springs or bands for crinolines and other articles of dress.
462. Michael Meyers, Great Alie Street—Improvements in woven fabrics.
463. George Ward and James Gaskell, Blackburn, Lancashire—Improvements in machinery or apparatus for making healds.
464. Duriez Fils, and Sidney Emsley, Roubaix, France—Improvements in machinery or apparatus for preparing fibrous materials to be combed or spun.
465. Francois E. Massey, Rue de l'Echiquier, Paris—Improvements in the construction of self-inking stamps for postal and other purposes.
466. William O'S. Brooke, Parliament Street—Improvements in apparatus for suspending electric telegraph wires.
467. John M. Dunlop, Manchester—Improvements in machinery suitable for cutting india rubber fillets.
468. Joseph Warren, Maldon, Essex—Improvements in chaff cutting machines.
469. Ludwig Pohl, Offenbach, Germany—Improvements in albums or books for holding photographs, engravings, and other representations, and in binding together sheets or pieces of pasteboard or such like stiff materials, especially for the purpose of forming such albums or books.—(Communication from Paul Luz, Offenbach, Germany.)
470. Thomas Spencer, Eccleston, near Prescot, Lancashire—Improvements in the manufacture of articles of earthenware, and of other plastic materials.
471. John Robinson, Rochdale, Lancashire—Improvements in machinery commonly called log frames for sawing timber.
472. James Hinks, Birmingham, Warwickshire—An improvement or improvements in glass chimneys for lamps with flat wicks.
473. Robert Mushet, Coleford, Gloucestershire—An improvement or improvements in the manufacture of cast steel.

Recorded February 25.

474. John Pinebbeck, Russell Street, Berks—Improvements in glass-water-gauges and pet-taps of steam-boilers.
475. Charles Sallows, Maidstone, Kent—Improving the action or motion of the Kent brush drill at present used in agriculture.
476. William G. Smith, Elizabeth Port, New Jersey, U.S.—An improvement in the cutting apparatus of harvesters.
477. William F. Henson, New Cavendish Street, Portland Place—Improvements in springs.
478. James Leeming, Bradford, Yorkshire—Improvements in jacquard engines.
479. William Dray, Farningham, Kent—Improvements in fire places.
480. Edmund F. Barnes, New York, U.S.—An improvement in railway chairs and being a combined chair and splice.
481. George Clark, Nicholl Square—Improvements in the manufacture and mode of laying down submarine electro-telegraphic cables.
482. George Clark, Nicholl Square—An improved method of connecting and fastening together blocks, plates, or slabs of wood, metal, or any other material.
483. Lucius A. Bigelow, High Holborn—Improved machinery for making boots and) shoes.—(Communication from George C. Prior, Duxbury, Massachusetts, U.S.
484. James Howard and Edward T. Bousfield, Bedford—Improvements in the construction of windlasses and implements applicable to steam cultivation.
485. John Barling, Belle Grange, Lancashire—Improvements in the mode of applying engine power to wheels and other like instruments employed in producing locomotion, whether by land or water.
486. James Young, Limefield, Edinburgh—Improvements in apparatus for the treatment or distillation of bituminous substances.
487. James Young, Limefield, Edinburgh—Improvements in heating apparatus.
488. Charles C. Regnault, Margaret Street, Cavendish Square—Improvements in the manufacture of oils, and in treating oils and fats for purposes of purifying, decolorizing, clarifying, and disinfecting them.

Recorded February 26.

489. Edward Ettrick, North Hylton, near Sunderland, Durham—Improvements in the construction of furnaces for the prevention or consumption of smoke.
490. George Davies, Serle Street, Lincoln's Inn, and St. Enoch Square, Glasgow, Lanarkshire—Improvements in mechanical beds for invalids, applicable also to tables for anatomical or surgical operations.—(Communication from Charles A. de Beriot, Paris.)
491. Robert Tiernan, Liverpool, Lancashire—An improved apparatus for drawing liquid substances from vessels containing the same.
492. William H. James, Old Kent Road, Surrey—Improvements in the means or apparatus for taking or catching of fish, parts of which improvement are applicable to propelling and to arresting the progress of ships and boats, and to the forming of communication therefrom to the shore.
493. Richard A. Brooman, Fleet Street—Improved materials for, and improvements in the manufacture of sugar moulds.—(Communication from Charles E. André, and Co., Clichy, near Paris.)
494. William Parish, New North Road, Hoxton—Improvements in the construction of tobacco pipes.
495. John T. Pagan, and Thomas B. Willans, Rochdale, Lancashire—An improvement in the manufacture of flannel.
496. John H. Bartholf, King Street, Holborn—An improved construction of rocking horse.—(Communication from Jesse A. Crandall, New York, U.S.)
497. Moritz Orenstein, Jewry Street, Aldgate—Improved means or apparatus for securing watches, and preventing the surreptitious abstraction of such articles from the pockets or other parts of the dress of the wearer.
498. Louis Sideman, and Samuel Philips, Manchester, Lancashire—Improvements in hats, or coverings for the head.
499. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in forges.—(Communication from Martin Chretiennot, and Pierre L. Rodet, Paris.)

Recorded February 27.

500. William Whalley, Granges, France—Certain improvements in machinery for carding cotton and other fibrous substances.
501. William Hudson, and Christopher Catlow, Burnley, Lancashire—Certain improvements in power looms for weaving.
502. Henry J. F. H. Foveaux, Strand, Westminster—Improvements in specula and in plugs used in connection therewith.
503. Charles Stevens, Charing Cross—Improvements in chimneys.—(Communication from Mr Desanges, Rue Laffitte, Paris.)
504. Charles Stevens, Charing Cross—Improved iron blinds.—(Communication from Md. Duclos, Rue Laffitte, Paris.)
505. Frederick Ransome, Ipswich—Improvements in the manufacture of artificial stone and cement.
506. John Taylor, Junior, Roupell Park, Streatham, Surrey—Improvements in the construction of roofs for buildings, and in the manufacture of tiles suitable for use for this and other purposes.

507. James T. Whitgrove, Worcester—Improvements in funeral or mourning carriages
508. Michael Henry, Fleet Street—Improvements in photography.—(Communication from Gaspard F. Tournachon, Boulevart Saint Martin, Paris.)
509. William Wealleus, Newcastle-upon-Tyne—Improvements in steam engines and boilers, and in propelling and steering vessels.

Recorded February 28.

511. Edward Brasier, Victoria Road, Deptford, Kent—Improvements in machinery for treating flax, hemp, New Zealand flax, Spanish or China Grass, and other vegetable fibres.
513. William J. Hay, Southsea, Hants—An improved glue or composition, suitable for covering the caulking of ships and other like purposes, for uniting wood and other substances, for filling up seams, and for use as a waterproof glue or composition generally.
514. Robert Laing, Ince, near Wigan, Lancashire—Improvements in the treatment of certain ores containing metals, and in obtaining products therefrom.
515. Robert Whittam, Accrington, Lancashire—Improved modes of heating the feed water of steam boilers.
516. Joseph Wilson, Manningham, near Bradford, Yorkshire—Improvements in means or apparatus employed in sawing wood.
517. Thomas Newton, Long Acre—Improvements in the accoutrements of horse soldiers' and other saddles.
518. Charles Beslay, Rue Menilmontant, Paris—Improvements in the manufacture and renovation of woven fabrics.
519. Robert Thompson, New Charlton, Kent—Improved machinery for cutting or sawing wood, stone, or any material capable of being cut or sawn by a rapid reciprocating motion of the cutting or sawing blades.
520. William Rose and Thomas Crowder, Gun Dock, Wapping—Improvements in apparatus employed for raising and supporting ships and vessels.

Recorded March 1.

521. William Galloway and John Galloway, Manchester, Lancashire—Improvements in moulding wheels and other metal articles.
522. John W. Mott, Lea Bridge Road, Clapton—Improvements in purses, bags, reticules, pocket books, dressing cases, and other similar portable receptacles.
524. Henri R. de St Martin, Frith Street, Soho—An improved apparatus for indicating the names of railway stations to railway passengers.
525. Edward T. Hughes, Chancery Lane—Improvements in time pieces.—(Communication from Monsieur Philippe, Paris.)
526. George Smith and James Carrick, Glasgow, Lanarkshire—Improvements in commodes or closets, and in bathing, washing, and other sanatory apparatus.
527. Roger Howorth, Blackburn, Lancashire—Certain improvements in the manufacture of healds for weaving, and in machinery or apparatus connected therewith.
528. Levi L. Sovereign, Strand—An improved agricultural implement for cultivating land, and for sowing seed.—(Communication from Guiden Huntington, Noridgeville, Oxford, Canada West.)
520. Michael Henry, Fleet Street—Improvements in distilling and rectifying, and in apparatus employed therein.—(Communication from Monsieur Ley, Boulevart St Martin, Paris.
530. Eugenius Birch, Parliament Street, Westminster, and Herman D. Mertens, Margate, Kent—Improvements in the permanent way of railways.

Recorded March 2.

531. John Ellis, John Stringer and John Bradock, Droylsden, Lancashire—Certain improvements in apparatus for lubricating the piston rods, valve rods, pistons, and valves of steam engines, and other rods or shafts to which a to and fro motion is given.
532. Archibald K. Irvine, Glasgow, Lanarkshire—Improvements in apparatus for stamping or marking letters or similar articles.
533. Robert Griffiths, Mornington Road—Improvements in the arrangements and construction of armour or iron clad steam or other ships.
535. William Hendry, Thistle Street, Hutchesontown, Glasgow, Lanarkshire—Improvements in the building of boilers and boiler flues for the consumption of smoke.
536. Edward J. Hughes, Manchester, Lancashire—Certain improvements in knitting machines.—(Communication from McNary Knitting Machine Co., New York, U.S.)
537. Charles Stevens, Charing Cross—An ointment for the cure of sores.—(Communication from Mare Pène, Rue Laffitte, Paris.)
538. Frederick Wright, Graham Street, Leicester—Improvements in circular knitting frames or machines.
539. George G. Sanderson, Park Gate Iron Works, near Rotherham, Yorkshire—Improvements in furnaces used in the manufacture of armour plates for ships and other structures.
540. Jacques B. Chaussenot, South Street, Finsbury—An improved apparatus for drawing off smoke and gases.
541. Sebastiano Botturi, Islington—Improvements in apparatus for weaving.
542. William E. Newton, Chancery Lane—Improved machinery for folding paper.—(Communication from Daniel F. Buckley and Bradbury P. Cilley, Manchester, New Hampshire, U.S.)

Recorded March 4.

453. Ephraim Sabel, Moorgate Street—Improved apparatus to be used in the manufacture of paper, applicable also to controlling the motion of travelling webs and fabrics.—(Communication from F. Thiry, Huy, Belgium.)
545. John James, Princes Street, Leicester Square—An improved instrument for sharpening slate-pencils, black-lead-pencils, lead-pencils, crayons, and such like articles.
547. Samuel A. Emery, Arundel Street—Improvements in portable apparatus for transporting locomotive engines and trains from one line of rails to another.
548 Robert Murphy, Crumlin Road, Belfast—Improvements in looms for weaving.
549. Hermann Hirsch, Bridge Road, Lambeth, Surrey—Improvements in insulating, and covering the conducting wires used for telegraphic purposes.
550. George Wilson, Sheffield—An improved construction of railway buffer.
551. Alfred V. Newton, Chancery Lane—An improved construction of hook for hook and eye fastenings.—(Communication from Alvin C. Mason, Henry H. Mason, and David M'A. Smith, Springfield, Windsor, Vermont, U.S.)
552. William E. Newton, Chancery Lane—Improvements in machinery for making bullets.—(Communication from Richard Gornall and William J. Hooper, Baltimore, Maryland, U.S.)
553. William Kay and Isaac Kay, Bolton-le-Moors, Lancashire—Improvements in machinery for doubling and double twisting yarn.

Recorded March 5.

555. Thomas Scott, Newcastle, Down—Improvements in the construction of roadways and tramways.
556. Edwin Whittaker and Jeremiah Clare, Hurst, Lancashire—Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.
557. William H. Haseler, Vyse Street, Birmingham, Warwickshire—Improvements in joints or hinges for jewellery and other articles having or admitting of metal joints or hinges, also for improvements in the manner or means of suspending such articles by or with such joints or hinges.
558. John M. Carter, Somerset House, Monmouth—Improvements in boots or other coverings for the feet.
559. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in pistons for pumps, steam engines, or other purposes.—(Communication from Narcisse Ponche, Joseph Scellier, and Marie P. A. Brasseur, Paris.)
560. Robert Brearley, Batley, Yorkshire—Improvements in treating woollen and union cloths for surface finish.
561. Emile Alcan, Coleman Street Buildings—A method of simultaneously marking and piercing or perforating plates of metal, cardboard, paper, and other material employed in looms for weaving figured fabrics.—(Communication from Michel Alcan, Paris.)
562. Charles Hanson, Haymarket, Westminster—An improved method of igniting or firing gunpowder, gun cotton, and other like explosive compounds in large and small fire arms and ordnance, applicable also to the firing of explosive compounds generally.
563. Alfred V. Newton, Chancery Lane—Improved machinery for forging horse-shoe-nails, spikes, and other like articles.—(Communication from Benjamin A. Mason, Newport, Rhode Island, U.S.)
564. William E. Newton, Chancery Lane—An improved fastening for buttons, studs, breast-pins, brooches, and other articles.—(Communication from W. Kuplenschmidt, New York.)
566. Andrew G. Corbett, Glasgow, Lanarkshire—Improvements in constructing and draining floors, suitable for stables and other places.
567. John H. Johnson, Lincoln's-Inn-Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in apparatus for administering medicated and voltaic baths.—(Communication from Edmond Hiffelsheim, Gustave Hagen, and Paul Baudet, Paris.)

Recorded March 6.

568. George B. V. Arbuckle, Charlton, Kent, and Thomas Scott, Bedford Street—Improvement in the locks of fire-arms.
569. Hugh A. Silver and Henry Griffin, Essex—Improvements in the manufacture of insulators and other articles in india-rubber which are required to retain a shape once given to them, in curing hard rubber, ebonite, or vulcanite goods, in moulding india-rubber articles in the construction of cellular fabrics in india-rubber, and in forming articles partly of soft and partly of hard rubber, or ebonite, or vulcanite, and in varnishes for india-rubber goods.
570. Joseph Statham, Lancashire, and William Statham, Openshaw, Lancashire—Certain improvemements in machinery or apparatus for mowing and reaping.
571. Andre D. Martin and Prosper V. du Trembley, Rouen, France—Improvements in apparatus for communicating sound signals.
572. George Eskholme, Rotherham, Yorkshire—Improvements in apparatus for regulating the supply of water to water closets, and for other purposes where an occasional or intermittent supply is required.
573. Joseph Hodgson, Back Lane, Newton Moor Hyde, near Manchester, Lancashire—Improvements in the pistons of steam engines, and in the buckets and plungers for pumps.

Recorded March 7.

574. William Wild, Bury, Lancashire—Certain improvements in machinery or apparatus to be employed in the preparation of cotton and other fibrous materials for spinning, called slubbing frames and roving frames.
575. William E. Wiley, Great Hampton Street, Birmingham, Warwickshire—An improvement or improvements in ornamenting surfaces.
576. Abraham G. Brade, Paris—Improvements in preserving animal or vegetable matters.—(Communication from G. Leuchs, Nuremberg, Bavaria.)
577. William Pidding, Borough Road, Southwark, Surrey—Improvements in preserving the aroma and other properties of coffee and cocoa from the effects of the atmosphere.
579. Thomas W. Evans, Rue de la Paix, Paris, France—Improvements in telegraphic cables.
580. Nicolas A. Pouard, Rue de L'Orillon, Paris—Improvements in breaks for railway rolling stock.
581. William E. Newton, Chancery Lane—Improvements in the manufacture of yarns or threads.—(Communication from Antoine L. Warnery, Lyons France.)
582. John Edwards, Horace Terrace, Shepherdess Walk—Improvement in the construction of carriage wheels.
583. George Hollands, Rochester, Kent—Improvements in the mode of, and apparatus used in, the process of fermentation.
584. William Clark, Chancery Lane—Improvements in warping, dressing, and finishing threads, and in apparatus for the same.—(Communication from Eugene Lcoee, Boulevart St Martin, Paris.)

Recorded March 8.

585. Bashley Britten, Barrington Road, Brixton, Surrey—Improvements in projectiles for rifled ordnance.
586. John H. Johnson, Lincoln's-Inn-Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvents in cravats for coverings for the throat and chest, and in the fastenings for the same, which fastenings are applicable to various other parts of dress.—(Communication from Simon Hayen, senior, Paris.)
587. Robert Leake, junior, and William Shields, Manchester, Lancashire—Improvements in machinery for engraving, stamping, or embossing cylinders and other surfaces used in printing and embossing fabrics and other materials.
589. Paul Doury, Rethel, Ardennes, France—Improvements in rifled or smooth barrelled arms, discharging projectiles forcibly propelled or not, and loaded by the breech.

Recorded March 9.

590. Thomas W. Davenport and Samuel Cole, Moseley, King's Norton, Worcester—Improvements in the manufacture of holders or handles for pens, pencils, and artists' or painters' brushes.
591. Benjamin Walker, and William Tilson, Lenton, Nottingham—Improvements in machinery or apparatus for the manufacture of bobbin net or twist lace.
592. Henry B. Barlow, Manchester, Lancashire—Improvements in apparatus for preventing the explosion of steam boilers.—(Communication from Charles Voelckner, Prague, Austria.)
593. Joseph Jacob, Golden Square—Improvements in the mode of, and apparatus for obtaining gas, and the application thereof for domestic, manufacturing, and other purposes.—(Communication from Carl Preisenhammer and Carl Weniger, Zoptau, Austria.)
594. Michael Meyers, Great Alie Street, Middlesex—Improvements in woven fabrics.
595. William H. Buckland, Barge Yard, Bucklersbury—Improvements in the manufacture of iron.

Recorded March 11.

596. Jsmes C. Fisher, Padfield, Derby—Improvements in machinery or apparatus for preparing and spinning fibrous materials
597. Joseph Bunnett, Deptford, Kent—Improvements in the manufacture of bricks and tiles, and in machinery for that purpose.
599. Abraham Myers, Hutchison Street, Houndsditch—Improvements in the manufacture of boots particularly adapted for ladies' wear.
600. George Williams, Park Nook, Quorndon, Derby—Improved apparatus for arresting the progress of railway accidents
601. John H. Johnson, Lincoln's-Inn-Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in life-belts and swimming-belts.—(Communication from Torrilhon, Verdier & Company, Paris)
602. John T. Hutchings, Charlton, Kent—Improvements in the manufacture of boots, shoes, and other coverings for the feet, and in tools for cutting the soles of such articles.
603. William Tillie, Londonderry—Improvements in machinery for making frills.
604. John Hirst, and James Hollingworth, Dobcross, Saddleworth, Yorkshire—Improvements in means or apparatus employed in weaving.

Recorded March 12.

605. James Tomlinson, Kegwork, Leicestershire—Improved buckle plate or apparatus used for attaching and detaching horses when in harness, or for other purposes to which the same may be applicable
606. 'Alexander S. Stocker, Wolverhampton, Staffordshire—Improvements in the manufacture of rails for railways.
607. Thomas F. Griffiths, Birmingham, Warwickshire—Improvements in machinery for raising or shaping metals.
608. Auguste Aerts, Place Verte, Anvers, Belgium—Improvements in apparatus for lubricating the moving parts of machinery.
609. Edward Frementin and Martisl Anbonnet, both of Bordeaux, Gironde, France—Improved apparatus for cutting wood for lucifer matches.
610. Gregoire L. Ripamenti, Bordeaux, France—Improvements in the nautical compass.
611. William Perry, Roll Turner, Wednesbury, Staffordshire—Certain improvements in the manufacture of gun-barrels
612. Robert H. Gratrix, Salford, Lancashire—Improvements in dyeing and printing textile materials and fabrics.

Recorded March 13.

613. George Spencer, Cannon Street West, London—Improvements in india-rubber springs for railway and other uses.
614. James Farren, Clapham, Surrey—Improvements in preventing incrustation in steam boilers, in tanks for containing the feed for the same, and in bars for the furnaces thereof.
615. Alfred Peek, Manchester—Improvements in treating or preparing textile materials and fabrics.
617. Douglas Hebson, and William G Rsmsden, Liverpool, Lancashire—Improvements in apparatus for obtaining fresh-water from salt-water.
618. William Walker and Dan Walker, Lindley, Yorkshire—Improvements in machinery for producing rovings or slubbings of wool or other fibres.
619. John Cimeg, Great Portland Street—Improvements in silvering glass and other surfaces.
621. Octave Saulay, Bordeaux, Gironde, France—Improvements in stopping or closing bottles, vases, cans, and similar articles, whether of glass, metal, or other material.
622. John L. Jullion, Tynemouth, Northumberland—An improvement in the apparatus used in the manufacture of paper.
623 James W. Aston, Cradley, Worcester—Improvements in the manufacture of vices.
624. Julius Jeffreys, Norwood, Surrey—Improvements in the construction of houses and footways.

Recorded March 14.

625. Arthur J. Joyce, Upper Gower Street—Improvements in means for indicating and representing various meteorological or atmospherical phenomena or influences
627. Robert T. Pattison, Daldorch House, near Catrine, Ayrshire, and Adam M Pattison, Glasgow, Lanarkshire—Improvements in the means and method of fixing colours in connection with the printing of woven fabrics and yarns.
629. William E. Gedge, Wellington Street, Strand—Improved apparatus for saving life at sea or in other waters.—(Communication from Joseph D. St Supery, Toulouse France)
631. Daniel Fryer, Carlton Square, Old Kent Road, Surrey—Improvements in the construction of candlesticks and lamps, in order to render them self-extinguishing.
632 Frederick Roessler, Bird Street, St George's-in-the-East—Improvements in apparatus or means for preventing locomotive engines and carriages leaving the rails.
633. William Clark, Chancery Lane—Improvements in bridges.—(Communication from Mathieu Castay, Paris.)
634. John H. Wilson, Liverpool, Lancashire—Improvements in pumps.
635. George Simmons, Frederic Place, Hampstead Road—Improvements in apparatus for making connections with gas and water mains.
637. Edwin T. Truman, Old Burlington Street—Improvements in masticators or apparatuses for preparing gutta percha, caoutchouc and other similar substances.
638 Edmund A Pontifex, Shoe Lane—Improvements in charging, tunning, or fermenting casks and vessels
639. James Hunter, Cambusnethan, Lanarkshire—Improvements in moulding and shaping metals.

Recorded March 15.

641. Bernard Samuelson, Banbury, Oxford—Improvements in machines for breaking up and cultivating land.
642. John A. Phillips, Earl's Court, Kensington—Certain improvements in the manufacture of white lead, and other salts of lead, direct from ores containing carbonate of lead.
643. Jules Bigourat, Gloucester Place, Brixton Road, Surrey—Improving the manufacture of harmoniums
644. William Collins, Sandon Street, Salford, Lancashire—Improvements in water, steam, and mercury gauges.
645. Charles Stevens, Charing Cross—An Improved regulator for looms.—(Communication from Jean J. Moeckel, Rue Laffitte, Paris.)
646. John Marson, Livery Street, Birmingham, Warwickshire—Improvements in breech-loading fire-arms and their projectiles.
647. Thomas Griffiths, Birmingham, Warwickshire—An improvement or improvements in machinery or apparatus for signalling on railway trains.
648. Arthur Granger, Holborn—Improvements in the manufacture of hats, bonnets, waistcoats, and trimmings for wearing apparel.
650. William Lorberg, Saint Mary-at Hill, Eastcheap—An improved process for obtaining and utilizing the chemical products of spent bark (commonly called "tan"), and all other woody fibres, also improved apparatus to be employed therefor.
651. Charles J. Burnet, Ainslie Place, Edinburgh—Improvements in the structure and construction of ordnance and other fire-arms, and of projectiles to be used with them.
652. Frederick Trachsel, and Thomas Clayton, Manchester, Lancashire—Improvements in the manufacture of gas, and in the apparatus employed therein.
653. Ely Green and John Green, Broadfield Mill, Lockwood, near Huddersfield, Yorkshire—Improvements in carding engines.
654. Angustus Smith, Brentwood, Essex—Improvements in machinery for cleansing or dressing bass, flax, and other vegetable fibres, applicable to the thrashing of corn and other grain.
655. William Schnell, Fitzroy Square—Improvements in the mode of and apparatus for manufacturing lucifer matches.
656. James Deakin, Birmingham, Warwickshire—Improvements in sash frames and sashes, and in balance-weights to be used therewith, which said balance-weights may be also employed with ordinary sashes or shutters, or for any similar purpose.
657 John Watkins, Birmingham, Warwickshire—Improvements in railway brakes.
659. Joseph Penn, Newton, Staffordshire—Improvements in whistles or water indicators for steam boilers.
660. Stanhofe Perkins, Manchester, Lancashire—Improvements in machinery or apparatus for drilling, boring, and cutting.
661. William Cloutman, Calverton, Berks—Improvements in tanks or vessels for dairy use.

Recorded March 16.

662. Alfred Krup, Essen, Prussia—Improvements in the construction of mortars, and in the means of attaching the same to the carriages used therewith.
663. John I. Taylor, Manchester, Lancashire—Improvements in apparatus for the manufacture of gas from coal, oil, or oleaginous substances, and other purposes.
664. John Holden, Manchester, Lancashire—Improvements in looms, and in apparatus connected therewith.
665. Adolphe Drevelle, Manchester, Lancashire—Improvements in presses for pressing or finishing textile fabrics.
667. Fleming Jenkin, Stowting, Kent—Improvements in the construction of bridges.
669. Alexander Prince, Trafalgar Square, Charing Cross—An improved electro-galvanic friction brush.—(Communication from Julius Imme, Berlin, Prussia.)
670. William F. Henson, New Cavendish Street, Portland Place—Improvements in railway carriage, buffer, and other springs.
671. Ebenezer F. Scott, Windsor Place, Dundee, Angushire—Improvements in breech-loading fire-arms.

Recorded March 18.

676. John Arrowsmith, Bilston, Staffordshire—Improvements in street railways and railways on common roads, and in locomotive engines and carriages for the said railways.
678. Constantine N. Kottula, Holborn—Improvements in the manufacture of soap.
680. William E. Newton, Chancery Lane—Improvements in machinery for drawing and spinning wool and other fibrous substances.—(Communication from John H. Bloodgood, New York, U.S.)

Recorded March 19.

685. Joseph J. O Taylor, Mark Lane—Improvement in the separation of silex and silicious and other matters from steel.
686. Arthur Wall, Canton Street, East India Road—An improved mode of preventing corrosion in boiler tubes.
688. James Smith, and Sydney A. Chease, Seaforth, near Liverpool, Lancashire—An improved telegraphic apparatus.
690. George W. Hawksley, Bridge Hill, and Mathew Wild, Carlisle Street East, Sheffield, Yorkshire—Improvements in steam boilers.
692. George Wilson, Yorkshire—Improvements in glass stoppers, applicable to feeding bottles, retorts, and other vessels.

Recorded March 20.

693. Thomas Brooks, Sunnyside, near Rawlenstall, Lancashire—Improvements in producing combinations of certain colours on cotton fabrics.
695. Henry A. Bartlett, Thetford, Norfolkshire—Improvements in apparatus to protect the flame of a candle from draught.
697. Richard A. Brooman, Fleet Street—Improvements in preparing caoutchouc adapted especially to dental purposes.—(Communication from Corneille L. C. C. Gobert, Paris.)
699 George Peacock, Regent House, Starcross, Devonshire—Improvements in anchors.
700. William E. Gedge, Wellington Street, Strand—An improved fabric for covering billiard and bagatelle tables and other similar uses.—(Communication from Jules Cordier, Amiens, France.)
701. Nathaniel Lloyd, John G. Dale, Church, near Accrington, Lancashire—Improvements in dyeing and printing textile materials and fabrics.
702 Joseph E. M'Donal, Litchfield Street, Soho—An improved fastening or coupling.
703. Levi L. Tower, Massachusetts, U.S.—Relating to heads for lead pencils, ink erasers and other articles of like character.—(Communication from Francis P. Hale jun., Boston, U S.)
704. Michael Henry, Fleet Street—Improvements in treating yarns and threads of silk and other fibrous materials for purposes of restoring colour thereto and improving their quality and appearance, also in apparatus employed in operating on yarns and threads.—(Communication from Charles Torue, Boulevard Saint Martin, Paris.)
705. Marie J. F. Chappellier, Brussels, Belgium—Improvements in manufacturing playing cards.
706. Simon H Scott, Rouen, France—Improvements in drawing instruments.

NOTICES TO CORRESPONDENTS.

We have been compelled, from want of space, to postpone the publication of several communications, as well as notices of inventions.

J. Law.—Your best course will be to obtain Weale's Treatise on Mensuration, which will give you much useful information on the subjects named in your letter.

J. Powell.—Your communication will receive attention in our next.

J. M'Donald.—We will endeavour to get the particulars of the invention you name. Upon reference to our pages, you will find several of a similar kind reported, some of them recently.

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

III.

The alteration in the patent laws of America has been effected at a strange period in the history of that nation, and most painfully must all who are interested in the real advancement of the human race be impressed, when they reflect upon the coincidence of that legislative improvement with the power of men's evil passions to arrest the progress of civilisation and of happiness. Amidst the horrid excesses of civil war, the claims of industry must be set aside; or if at all encouraged, invention will only be so in the departments likely to provide means of destruction. Patents for implements of war may be taken out in the no longer United States, and there will surely be a demand for such articles as may facilitate slaughter and ruin; but how are the rights of patentees to be protected in the midst of all this confusion, and how are the ordinary applications of industry to attract attention, when men's minds are excited on the weighty problems now brought forcedly before the American people? Political affairs and industrial operations are connected by laws of a very subtle, but, at the same time, of an inevitable nature; and the interests of countries, like England and America, which stand to one another in the relation of producers and consumers, are so interwoven, that even *we* are forced to dwell anxiously on the great events the forthcoming contest must produce. The science of practical mechanics, with which we are more immediately connected, must suffer by the withdrawal of the genius of the American people from its peaceful developments; had Englishmen, as a nation, only that narrow motive, the present fearful crisis the United States are about to traverse, must fill their minds with pain and grief. How infinitely sadder must be our reflections when we recollect that the respective parties in the contest are offshoots from our own Anglo-Norman stock!

Nature, too, seems to have lately visited the American continent with unwonted severity; and, by the fearful catastrophe of Mendoza, in the Argentine Republic, to have taught men that she can at times re-assert her power over their wills. The earthquake which lately took place at the town above-mentioned should not be forgotten by those of our countrymen who may be disposed to enter upon such speculations as the Isthmus of Nicaragua canal, so recently attempted to be revived; for the district selected for that proposed line of communication traverses precisely one of the most active seats of volcanic action in the world. It is singular, by the way, that this Nicaragua canal has been hitherto promoted by the same active spirit which has urged forwards the impracticable scheme of the Suez canal; and that, in both cases, the physical laws of the intended scene of operations have been ignored. There is no imperial road, however, to engineering; and nature will always make herself felt, if her laws be infringed. Emphatically, this seems to be the case with that strange delusion, the Suez canal; and it is to be feared that it would also occur in the highly-disturbed district of Central America, though, of course, under very different conditions in the respective instances.

And whilst thus alluding to events happening in foreign countries, it may be worth our while to call the attention of our readers to the marked intelligence, and to the perseverance, with which the government of Russia is directing its efforts towards the development of its extreme Asiatic dependencies. Whilst *our* rulers have allowed themselves to be made the dupes of a badly-conducted essay for the establishment of a deep sea telegraph to India, and have discouraged every attempt to establish an overland telegraph through the valley of the Euphrates, the Russian government has pushed forward its overland communication, through Siberia to the shores of the Chinese and Japanese seas. Europe, in general, will gain by this great work, and great credit ought to be awarded to the Imperial government for its energies in the matter. Meanwhile, we cannot refrain from expressing our regret that the manufacture of deep sea cables should still be so little understood, or at least that the dangers attending their use should be so little under control, as to render them almost worthless. It would seem to be impossible, in the present state of electrical science, to maintain the insulation of the wires immersed in sea water, especially in warm climates, and that it is necessary to employ a different conductor from the one now used. If this cannot be economically done, long lines of deep sea telegraphs must be abandoned; and if England desires to communicate rapidly with India, or with China, she will be compelled either to use the Russian overland telegraph, or to establish an independent line through friendly countries in Central Asia. All these points of contact between Europe and Asia have, however, a strange interest, extrinsic to the industrial operations. The proverb, "lux ex oriente," no longer applies; the light of civilisation now comes from the west to the east, and civilisation seems flowing backwards towards its source.

It is much to be regretted that the new India Board should, at this precise crisis in political and industrial affairs, have taken up the worst traditions of the late East India Company, and should have thought fit to discourage the introduction of English capital into those possessions. The conduct of the Indian administration towards the Irrigation Companies has, in fact, been such as to throw great disfavour upon any operation which might come under the influence of a body which seems to be conducted on the principle of taking every advantage of the parties who are bold enough to undertake a public service. No doubt all government departments are exposed, more or less, to the same accusation; but England has so manifest an interest in the improvement of India, and the industrial and agricultural development of that country, (at the present moment especially, when the cotton-growing States of America are likely to be withdrawn from our markets,) must be so essential to our manufacturers of Yorkshire and Lancashire, that the conduct of the fine gentlemen of the India Board becomes worse than ridiculous. The story of the indigo planters is not one which would be likely to induce our capitalists to run after new sources of investment in a country where the laws of real property are in so very unsatisfactory a state as they are in India; and the attempt now being made by the State to drive hard bargains with the Irrigation Companies will afford little inducement for Englishmen to turn their attention to the growth of cotton in that country. New fields of production must, however, be soon found; and though Moreton Bay and Queensland may be adapted to the growth of that staple, and the abundance of Chinese labour may remove one of the great preliminary difficulties in the case, there still can be no reason why our rulers should, as it were systematically, throw difficulties in the way of the companies who seek to supply the one thing wanted in all Indian agriculture. We dwell upon this subject, irrelevant as it may appear to our ordinary inquiries, because the new field for the exercise of English enterprise and ingenuity, which must be opened by the attempts of our colonies to supply the cotton hitherto almost exclusively obtained from America, must give a great impetus to the science of practical mechanics. The makers of machinery here would perhaps do well to turn their attention to the improvement of the cotton gin, and to the other appliances required to bring that article into a merchantable state; and they would in that case have a direct interest in supporting the men who are engaged in facilitating the growth of the raw commodity.

A rather curious event has taken place of late in the province of the Savoy, which illustrates forcibly the connection between the nature of a government and the prosperity of its subjects. The event to which we allude is the discovery of mineral veins in that district, almost immediately after it had passed out of the hands of the Piedmontese into those of the French. This is the old story of California over again, and we ourselves can but congratulate the Savoyards on their change of rulers. If the kingdom of Italy, however, should not be governed with more intelligence than the hereditary dominions of the king of Sardinia have hitherto been, it is to be feared that our habitual readers will not find much interest or advantage in its existence. Yet even the island of Sardinia itself might furnish one of the most glorious fields for enterprise. At present it lies utterly barren and waste, an outlier of Africa in the very midst of the Mediterranean, on the high-road between the West and the East. The interests of the inhabitants of this island, of such immense natural value, would be really much advanced by its transfer from its present rulers to the energetic government of France; and it is sad to witness the neglect of such a field for industrial operations, simply because political jealousies are allowed to interfere with the progress of civilization. In the meanwhile, we may state that, from personal observation, we can assure our readers that the mineral wealth of the island of Sardinia is almost inexhaustible, and that the application of many of our processes of agriculture, or of our improved agricultural engineering, would in fact increase the productions of its soil to an unlimited extent.

English builders, it may here be added, would do wisely at the present day, to turn their attention to the methods of execution adopted by their brethren in Paris, in some of the details of their profession. Not only is the manner in which wrought-iron is now applied in the construction of houses in that city, worthy of admiration and study, but the introduction of hoisting machinery, for economising labour, has been effected on a scale which ought to induce us to follow the example. The masons of Edinburgh, it is true, have latterly made an appeal to the mechanical engineers of their country, to invite them to discover means of working stone by machinery, and thus of relieving the master masons from the constantly recurring annoyance of strikes. The problem so raised is a very interesting one, and it has already received the commencement of a solution in Hunter's stone planing machinery, which might, by the way, be applied far more generally than it now is, in the conversion of stones of a uniform texture and degree of resistance. In practice, however, the difficulty will arise from the unequal resistance of the stone: and, moreover, it is only exceptionally that large ashlar blocks can be obtained, in the United Kingdom at least, in sufficient quantities, and at sufficiently low prices, to allow of its being used as a common building material. Mechanical engineers, therefore, must address themselves to the dressing and hoisting of rubble masonry, whether coursed or random; perhaps, also, many of the details of brickwork might also be facilitated by mechanical means, especially in large buildings, wherein great quantities of materials have to be employed. Under any circumstances, it is strange that in trades of such essential every-day importance, as those connected with buildings, labour-saving machinery should be so little used as they are by London builders, who are now suffering so severely from the disturbed state of the labour market. It is worthy of remark that English steam-ship builders are turning their attention to the methods to be employed for executing the heavier operations on ship-board by machinery, and that contrivances for working yards and sails, for loading and unloading, for working windlasses and pumps, are now commonly introduced. Surely builders might learn much from these practical lessons; for the operations to be effected in the respective cases are very analogous to one another.

The extensive works about to be undertaken in London for the new Law Courts, the great sewers, the Thames embankment, the Foreign and India Offices, and the new lines of railway, with their viaducts and bridges, will indeed force these questions upon public attention; for it must manifestly be impossible to carry them into execution in the present condition of the labour market in the building trades. Much mischief has been done by the unaccountable conduct of the *Times*, in disguising the real state of the dispute, now raging as fiercely as ever; for by this conduct public attention has been diverted from a subject which may assume a very grave, almost a national importance. We repeat that at present the labour market throughout England is under supplied with skilled artizans, and that, therefore, if our rulers and our speculators persist in carrying on the works above mentioned at once, they must be prepared either to yield to the demands (reasonable or unreasonable) of the workmen, or to provide some substitute for them. In railway works and bridge building this can be effected with comparative ease; and the modern systems of cylinder foundations, screw-piles, wrought-iron plate or lattice-girders, have dispensed with much of the mere animal labour which was formerly employed. Greater progress might be made in the same direction, if our architects and engineers were less timid in the adoption of new process of construction and of new materials; but the stern necessities of their positions will soon compel them to depart from this routine. In the meanwhile, we cannot refrain from expressing the hope, that in the erection of the proposed new bridges over the Thames the general interests of the parties directly affected by its engineering state may not be forgotten, and that those structures may be built so as neither to endanger existing structures, or to render future improvements of the navigation impossible. The state of the communications betweeen the banks of the Thames in the metropolis, is at present simply disgraceful; and as it would easily admit of remedy during the progress of the intended works, there can be no reason why this disgraceful state should be allowed to continue. At Dresden, Cologne, Liege, Paris, and elsewhere, the railway bridges are made in such way as to accommodate ordinary traffic; and it would be desirable to adopt the same system here.

Whilst thus speaking of railway bridges, it may be of interest to our readers to observe that the Admiralty have, in their usual spirit of exaction, called upon the North-Western Company to execute another of the sublime follies of the Britannia and Saltash bridges style. That branch of the Administration have made their consent to the erection of the bridge over the Mersey, at Runcorn, contingent upon its execution in five spans of 300 feet opening, and 75 feet above high-water line. Let us only hope that the Directors may not be induced, by any notions of economy, to attempt in this instance the application of the suspension principle to a railway bridge. There is, unfortunately, a tendency at the present day to adopt this latter mode of construction; but the results of the Niagara bridge, according even to the statements of its warmest advocates, do not seem to justify our imitating that structure, however well it may suit the requirements of the American traffic in the particular locality where it is erected.

Dr Letheby has latterly called the attention of the authorities, with whom he is connected, to the pollution of the Thames, by the discharge of the foul liquors from the manufacturing establishments on its banks, or from the foul liquors which find their way into the stream. In so doing, Dr Letheby discharged his duty very properly; and if the gas companies and the other manufacturers, who are thus guilty of creating a public nuisance, should be seriously punished, they would receive but a small amount of sympathy. But this question is a much more serious one than it appears at present to be; and it in fact involves the whole subject of the discharge of sewerage into the water courses of the country. It is absurd to prosecute those who produce an infinitesimal pollution of sewerage, when the sewerage itself, with all its abominations—and all its intrinsic value—is allowed to flow away without any systematic attempt at its disinfection or purification. It is to our minds more than a matter of doubt whether the sanitary authorities of our country have not done as much of injury as of good, in compelling the towns which have placed themselves under the guidance of those new lights, to execute sewerage works, without at the same time rendering it compulsory to execute disinfecting works, or to adopt some means of preventing the foul sewerage from contaminating water-courses. We begin these things at the wrong end very often in England; and it has been emphatically so in this case, and the improved drainage and sewerage of our towns has become a serious evil to the country: yet, having done this, our rulers very logically cast about to discover the means for preventing the destruction of fresh water fish! Joking apart, however, the field for invention, with a view to the extraction of the fertilising matters contained in sewerage, is still unoccupied; disinfection has been, more or less, successfully accomplished; sewerage has not hitherto been economically applied to any good purposo, so far as we can discover, at least.

In a subsequent part of this Journal will be found a translation of some papers still in course of publication by M. Fremy, one of the most eminent of the living French chemists, upon the composition of steel.

Plate 273.

Vol. IV.

ROTATORY ENGINE,

BY Mr EDWARD SCHEUTZ. *PATENTEE.* STOCKHOLM.

Fig. 1.

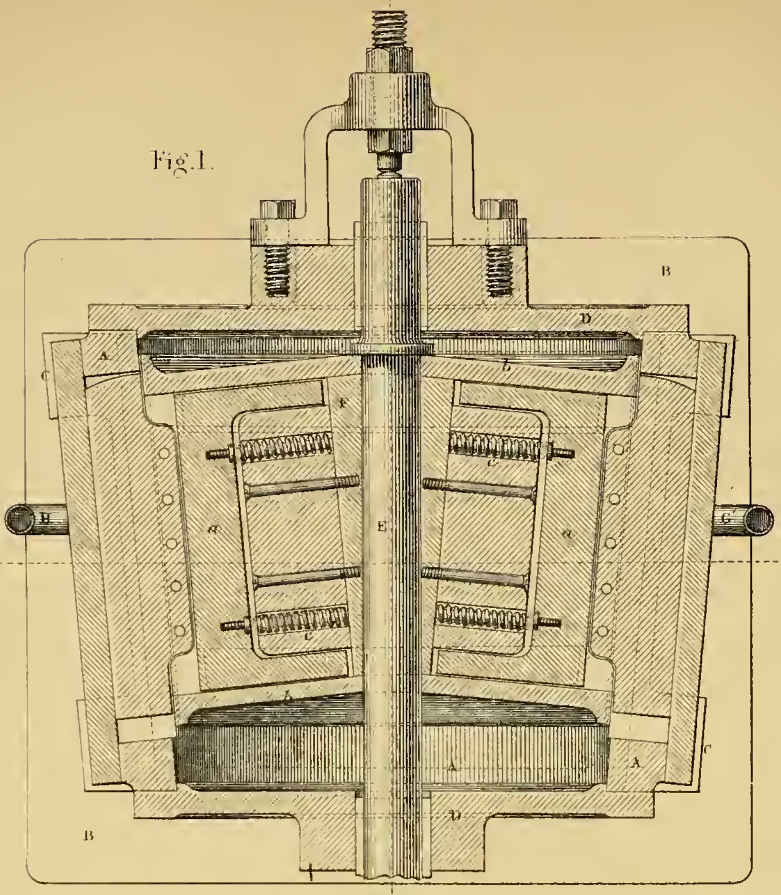


Fig. 3.

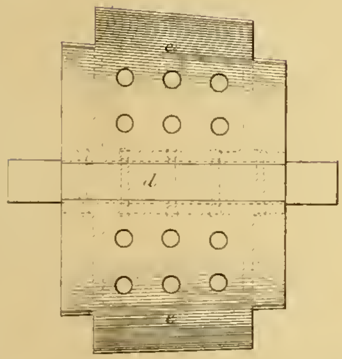


Fig. 4.

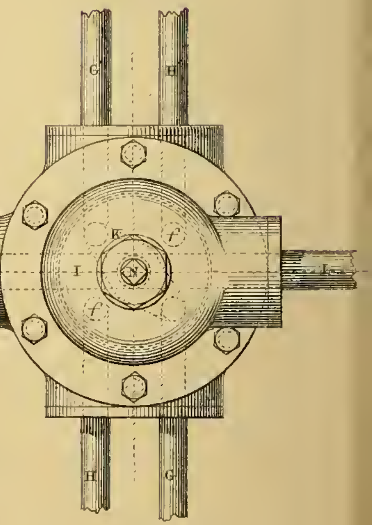
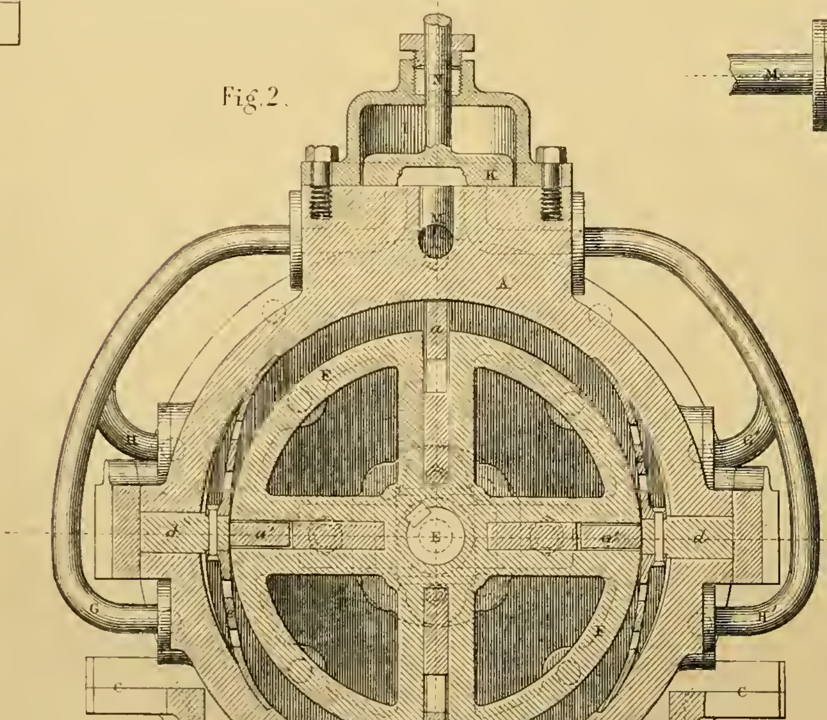


Fig. 2.



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These papers have attracted so much attention, as to render it advisable to give them in full; but we expressly reserve our own right to return at some future occasion to the discussion of the originality of the discoveries M. Fremy claims credit for, and of the correctness of some of his opinions. In France itself, M. Fremy has not escaped bitter criticism by M. Caron, on the score of originality; and, unless we are much deceived, Mr C. Binks, in a paper read before the Society of Arts, nearly four years ago, propounded opinions, and recorded experiments, which were strikingly like some of those to be found in M. Fremy's papers; whilst the remarks by Gmellin upon the metallic nitrides, short though they are, might easily have guided an inquirer to the results M. Fremy claims as his own unaided discoveries. In all these matters, however, society owes the greatest obligation to the men who apply abstract science in a practical manner; and, to the public, the precise degree of originality in the investigation is of less importance than the useful result obtained. M. Fremy has certainly succeeded in directing attention to the scientific part of the manufacture of steel, and on that account at least he deserves the thanks of all who are interested in the arts connected with practical mechanics. It is impossible to foresee the revolutions which must ensue in all branches of construction, from the certain and economical production of a substance possessing the physical properties of steel.

Some time since, Dr Livingstone mentioned that the steel-plate used for the launch he took out for the navigation of the Zambesi, had decayed in a very remarkable manner. Possibly, an investigation of this subject, by the light of M. Fremy's results, might furnish an explanation of the causes of decay, as well as of the changes produced in wrought-iron in some waters.

ROTATORY ENGINE.

(*Illustrated by Plate* 273.)

Mr Edward Scheutz, of Stockholm, one of the inventors of the calculating machine lately brought over to this country, and noticed in our eighth volume, has recently patented a rotatory engine of an ingenious and simple construction. Figs. 1 and 2 of our plate 273, represent respectively a horizontal and vertical transverse section of Mr Scheutz's engine, and figs. 3 and 4 are details of the same. One great feature in this rotatory engine is the use of a slightly conical or tapered cylinder and piston, in lieu of having them made with perfectly parallel or cylindrical surfaces. By this arrangement a simple means is at once afforded for remedying the defects of wear and tear, as by merely setting up the piston longitudinally within its cylinder, if we may so term it, the parts may be tightened up so as to fit with the greatest accuracy, whilst at the same time the degree of friction may be nicely adjusted. The cylinder or piston case, A, the taper of which is clearly shown in fig. 1, is mounted upon a suitable bed plate, B, by the lateral flanges, C C. The end covers, D D, are bolted steam-tight to the casing, and are provided with central steam-tight bushes or packing-boxes, through which the main shaft, E, passes. Upon this shaft is fixed the piston, F, provided with four radial sliding diaphragms, *a a*, *a' a'*, which work in slots or recesses formed within arms cast inside the piston, the body of which is hollow, but is kept closed at each end by the two end plates, *b b*. The diaphragms, *a*, are disposed diametrically opposite to each other, and are pressed outwards against the inner surface of the cylinder by helical springs, *c c*, contained inside the body of the piston. The extreme ends of the piston only are in actual contact with the cylinder, the intermediate portion of the surface of the piston being of less diameter than the ends, so as to leave a steam space all round between this portion of the piston and the cylinder, as shown in fig. 2. On diametrically opposite sides of the cylinder are fitted two stationary stops, *d d*, which accurately fit the surface of the piston and its inner lateral flanges or enlarged ends. On the upper and under side of each stop, *d*, is secured a curved or inclined plate, *e*, shown in the detail, fig. 3. The curve of these plates is so arranged as to die off or merge into that of the inner surface of the cylinder, as will be clearly seen on referring to fig. 2, and their object is to cause the sliding diaphragms, *a a*, of the piston to be forced inwards as they pass in front of the curved plates, and so enable them to pass the protruding stops, *d d*, after passing which the helical springs force the diaphragms out again, the curve of the plates, *e*, enabling them to resume their former position against the cylinder in a gradual manner, and without the occurrence of any sudden shock or blow. G, G', and H, H', are the steam and exhaust pipes. They each open into opposite sides of the cylinder behind the curved guide plates, *e*, the one above and the other below each stop, *d*. The plates, *e*, are perforated, as shown, with numerous holes, to allow the steam to have free ingress and egress to and from the cylinder. These four pipes all open into the bottom of the valve chest, I, which is ground to receive the disc valve, K. The face of this valve fits steam-tight on to the bottom of the steam chest, and is held in contact therewith by the pressure of the steam in the steam chest. A cavity or recess is made on the under face of the disc, which recess is of sufficient length to connect the orifices of either pair of diametrically opposite pipes. *f f* are two apertures made through the disc, so as to correspond with the other pair of diametrically opposite orifices, as will be readily understood on referring to the detail plan of the valve chest, fig. 4. L is the steam pipe, and M the exhaust or escape pipe, the former opening into the upper part of the valve chest above the valve, and the latter communicating with a central part or passage in the bottom of the valve chest. In the portion of the valve shown in fig. 4, the steam will pass through the apertures in the disc which correspond with the orifices of the pipes H and H', and will enter the cylinder simultaneously on opposite sides, forcing round the piston in the direction of the arrow by the pressure exerted on the two opposite slides or diaphragms, a' a', the exhaust or escape taking place at the same time through the pipes G and G', which are in direct communication, by means of the recess in the under side of the valve, with the exhaust pipe, M. By imparting a quarter turn to the disc valve, by means of the valve spindle, N, it is obvious that the functions of the pipes will be changed and the engine reversed, as the pipes G and G' will then be steam pipes, and the pipes H and H' exhaust pipes. By imparting an eighth of a revolution only to the valve, the steam will be shut off from the cylinder, and the engine consequently stopped.

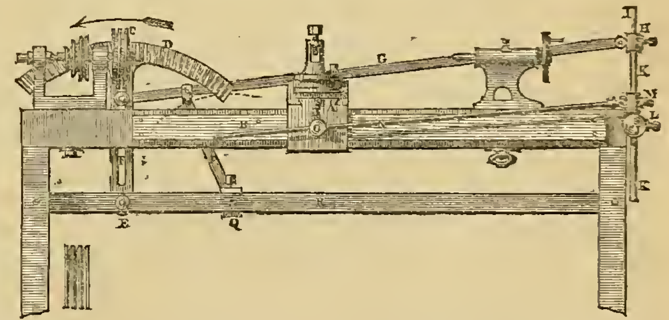
Mr Scheutz has informed us that his engine has been successfully experimented upon in Sweden, and has forwarded to us reports of scientific men of eminence in that country, which speak most favourably of its working. Several small iron steam-boats are now being fitted up with this engine in Sweden, and two or three of from 6 to 7 H. P. are under construction.

We shall be glad to give our readers further particulars and practical data so soon as the invention has been fully tested: as it is yet in its infancy.

SCREW CUTTING LATHE.

The annexed engraving represents a novel description of screw cutting lathe, designed and constructed by Mr T. E. Merritt of Rochester, Kent, to cut screws of different pitches. The simplicity of the movements of the slide-rest, necessary to produce true or differential screws, will be readily understood from the following description. The slide-rest, A, travels along a dovetailed bar, B, bolted on to the front of the lathe bed. C, is a large screw chuck, having a nose piece to fit all the usual chucks required. The edge of this large screw chuck is cut with a strong slow-pitched screw, which gears into a portion of a screw bevel wheel, D, the oscillating centre of which is carried by a cross bar, E, fixed to the back of the lathe bed. The radius bar, or arm, F, of the face wheel has a slot to allow the end of the rod, G, to be properly adjusted at any point between the limits. The other end of the rod, G, is attached to an upright block slide, H, mounted on an upright rod, I, fixed on the furthest end of the cross shaft, J. This cross shaft is carried by bearings on the end of the lathe bed. Through the nearest end of the cross rocking shaft, the rod, K, slides freely, and can be fixed and adjusted to any height, by means of pinching screws, L. The driving rod, N, which works the slide-rest, A, is jointed to it and can be fixed at any distance from the end of the rod, N, by means of the pinching screw in the swivel boss, O, through which the driving rod passes. A radiating link, P, is detachable from the rod, G, when regular screws are to be cut, but for differential screws the link is attached to the rod, G, and the saddle-end, Q, is adjusted and fixed at the particular part under the cross bar, R. The revolution of the mandrel carrying the screw chuck, C, causes the screw quadrant, D, to oscillate in the direction indicated by the arrow, which motion is communicated to the slide-rest, A, through the intervention of the two connecting rods, G and N, and these rods can be adjusted by lengthening or shortening the travel to suit the pitch of screw required. The engraving shows the lathe arranged for cutting differential screws, and as the dotted arc, indicating the path of the link, P, varies considerably from that of the arm of the screw quadrant, a differential motion of the slide rest is by this means produced. The stud

Fig. 1.



working in the slot of the quadrant arm is, by the radial motion of the link, P, brought nearer to the centre, E, and consequently a decreased motion is imparted to the slide-rest, whereby a quick motion at the beginning gradually reduced towards the end, produces the differential motion required; but when a regular screw is desired, the radiating link, P, is disconnected, and the different centres of the connecting rods are adjusted to suit the pitch required. Of course, straight flutes or grooves can be cut by merely fixing the material to be operated upon, so that it cannot turn during the time one straight groove is being cut. To cut left hand screws, the connecting rod, M, has only to be removed to the lower side of the rocking shaft, J.

Specimens of the work produced by this lathe may be seen at the "Society of Arts Exhibition."

ON COAL-PIT ACCIDENTS.

BY CAPT. J. ADDISON, H.M. INDIAN FORCES.

In 1842 I made known my plan, at least that part of it which relates to the voltaic battery, for I had invented no other at that period, to the eminent geologist, the late Rev. Dr Buckland, who highly approved of it, and transmitted my letter to Mr Sopwith, of Newcastle-upon-Tyne, a civil engineer of eminence, requesting his opinion upon it, which was to the effect that it was highly ingenious, but impracticable, on account of the damage he supposed the mines would sustain. But it is surely preferable to destroy the gas by electricity, even if damage did ensue, than that the gas should destroy the mines; yet it is reasonable to suppose if the gas were destroyed on my plan, whenever it could be discovered, the accumulation would not be sufficient to damage the workings to any extent, and perhaps not at all.

I also submitted my plan to Mr Smith of Tipton, Staffordshire, author of the Miner's Guide, who much approved of it, and three weeks after wrote me to say that an explosion had occurred, which killed five miners, and concluded his letter with 'had your plan been in use, these men would still be in existence."

Two months subsequent to this, I wrote to him to suggest a plan for ameliorating the ventilation of coal mines, by boring a hole, on the artesian well system, as a substitute for a third shaft at the extreme end of the mine for the purpose of creating a thorough draught; to which he replied, "I like much your suggestion of a substitute for a third shaft, but you must excuse me when I frankly declare, that the expense attending it would be considered too great by the Colliery owners." I have alluded to the voltaic battery merely to show that I was the first to propose the use of electricity for preventing loss of life by coal-pit explosions.

If a coal-pit were charged throughout with gas, it would preclude the possibility of using the voltaic battery, but I have observed for the last eighteen years, that, in 90 cases out of 100 these accumulations seldom extend beyond a certain working. I will name a case in point, as an example:—

"A colliery explosion occurred February 13th, 1860, at Higham, in one of the pits, the property of Messrs Charlesworth,—eleven men and boys perished by the fire-damp, and three others were terribly injured. The Colliery is a very extensive one, being 210 yards deep, in which three seams of coal are worked, the deepest being the well known silkstone bed. It was while working this seam that the accident occurred.

"Happily the explosion was confined to one of the workings, otherwise a more serious calamity might have taken place, as there were at least 120 men and boys in the pit at the time. It is rather singular that, contrary to the explosions of fire-damp, no report was heard, the men at the top not being aware of the fact."

Fifteen years ago an explosion occurred in the Hasewall Colliery, when no report was heard, though 100 persons were killed; only 15 of whom in the locality where it occurred being slightly scorched about the face, the remainder having succumbed to after-damp. It was stated that not a shilling's worth of damage was done to the workings. When no report is heard, it no doubt arises from a deficiency of atmospheric air, in proportion to the gas it is combined with.

From 1853 I have entertained an opinion that the Davy-lamp is not to be depended upon for preventing of carburetted hydrogen gas in Coal-pits, and still less so for ascertaining its presence.

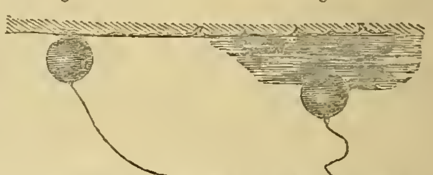
An explosion occurred in the Victoria pit, near Glasgow, in 1851, the ventilation of which was considered so perfect as to induce the owners to get a beautiful model made of it for the purpose of sending it to the Crystal Palace, but the day previous to that on which it was to have been sent, a terrific explosion occurred, which killed every man and horse in the pit at the time, the former being 60, and the number of the horses I have forgotten; the men were so frightfully burnt as to be only recognized by their clothes.

I have alluded to the above, to show that no mine can be said to be well ventilated unless there be a perpetual and ample supply of atmospheric air, to render any eruption of gas innocuous, whether from a blower, alias fissure, or evolved from the pores of the coal, the moment it enters the workings, or any other part of the mine.

I was much surprised on reading an account of the conclusion of the Risca inquest, to perceive that no allusion was made to the fans of Mr Nasmyth, the inventor of the steam hammer, which have been used with so much success for the last nine years in Earl Fitzwilliam's pits at Elsear, near Rotterham. The fan throws into the mines 200,000 cubic feet of air per minute, and this quantity can be increased when required by a signal from below. There is an enormous difference in favour of Mr Nasmyth's fans over the ventilating machine at the Risca Colliery, which throws into the mine from 35,000 to 44,000 cubic inches of air per minute, for ventilating a pit, which I believe is very much larger than any of those above referred to.

In mines of magnitude, it has been my humble opinion for the last eighteen years that a communication with the surface and the workings most remote from the shaft is absolutely necessary for preventing those destructive explosions which often occur in them. For instance, that in the Wigan Colliery, about eleven years ago, which killed every miner in the working to the number of 60, and three years subsequent, another occurred in the same working which killed 145, 45 of the latter being buried under the roof, this working being most distant from the shaft; and it appears to me, that nothing could answer the purpose better, and at so little cost for accomplishing this, than by boring a hole on the artesian well system, from the surface into the workings specified, which would not occupy the 20th part of the time required for cutting a shaft, nor a 20th part of the expense. With a current of air thrown down by one of Mr Nasmyth's fans, the gas in these workings would be rendered innocuous as soon as evolved from the pores of the coal, or from any other source, it would also be another place to retreat to in case of an explosion in the centre of the mine.

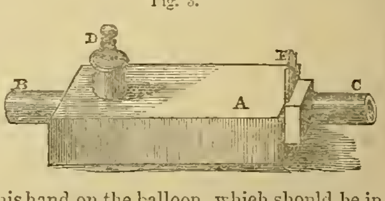
Fig. 1. Fig. 2.



I consider I have good reasons for asserting that the great desideratum, a mode of detecting accurately, and quickly, the presence of gas in any part of a mine has been discovered by me, which would unerringly show to the sight, as it were the exact extent of the fire-damp, with as much accuracy as a good barometer indicates the state of the weather, and to the want of this, the loss of life by coal-pit explosions is to a great extent attributable, for the miners hitherto have seldom been able to quit the mine early enough to avoid the danger impending over them.

The following is my plan,—I use toy balloons attached to a string as a test for ascertaining the presence of gas in coal-pits, as they cannot float on a body similar to what they are inflated with. I placed a balloon 7 inches in diameter, in a glass case 20 inches in height, and 9 in diameter, and enclosed the bottom by pasting paper over it, I then made a hole in the centre to allow a valve to pass through, for the purpose of introducing a jet of gas, when the balloon in the course of a few seconds descended to the margin of the gas, and as soon as I removed the case from the jet the balloon in the course of a few seconds ascended to its natural position, the top of the case. I then removed the paper from the bottom of the case, and again held it over a jet of gas, when the balloon began to rise and fall alternately as I removed the case from the jet, or held it over it. The overmen on going their rounds to ascertain the state of ventilation, should each take a balloon about eight inches in diameter, inflated with hydrogen gas, and attached by a silk thread to a ¼lb weight for the purpose of testing the working in the following manner:—

Fig. 3.



The overman should place his hand on the balloon, which should be in contact with the weight on the ground. If there be no accumulation of gas, the balloon would ascend to the roof of the working, and remain in contact with it, as shown at fig. 1; but if gas is present in the working, it would ascend no higher than the margin of the gas, as shown in fig. 2. If the ventilation were not good, it would ascend slowly and perpendicularly, and if the contrary, quickly and obliquely, by which the rate of the current of air passing through the workings could be accurately ascertained by counting the number of seconds it took the balloon after quitting the weight, to come in contact with the roof, and by measuring the distance from the weight to the balloon.

The use of the balloon would solve a problem which has long been a desideratum, namely—when an explosion occurs, no statements are to be depended upon as to the time the gas has been accumulating, all is mere hypothesis—it may be the accumulation of a day, a week, a month, or a longer period; but the state of the ventilation by my system could at all times be correctly ascertained.

It would also be found equally efficient for ascertaining in the course of a few seconds the presence of carburetted hydrogen gas, in the holds of coal-laden vessels, which is often exploded with destructive effect to life and property. My plan is the following:—

I make a vent in one of the hatches, seven inches in diameter, and a groove round it for shipping a glass case, about twenty inches in height, the vent when not wanted to be closed with a plug, a hole five feet deep, and four feet square should be left below the hatches for allowing the gas to escape more rapidly, and this should not be filled up until a few hours before sailing. If there were any gas in the hold the balloon would descend in the course of a few seconds until it came in contact with the hatch, if none, it would remain in contact with the top of the case, its natural position,—the hatches ought not to be battened down before being thus tested.

I detect the presence of carbonic gas in a mine, or well, by a balloon inflated with atmospheric air; if in a well by attaching a thread to it and throwing it in. If there were any gas, the balloon would float upon it, and when drawn up would be found dry, if no gas the balloon would come in contact with the water. I inflate the balloon with hydrogen gas according to the formula of Cavendish for discovering hydrogen gas in mines, the cost of two per diem being about 10d. which could be inflated in ten minutes with a portable gasometer, weighing 5½lbs., and if the bladder of an ox or pig were inflated with compressed hydrogen gas, it would remain in all probability undiminished for a considerable period.

I suggested in 1858 the following plan as an auxiliary to the present mode of ventilating coal mines:—I would have cast-iron pipes similar to those for conveying gas, carried from the bottom of the shafts to every working, and to any other locality if necessary, and an apparatus similar to that I have shown in the accompanying engraving, fig. 3, should be placed at the centre of every working for the purpose of concentrating as much air as possible, of that thrown into the mine by Nasmyth's fan, and as near as possible to any accumulation of gas discovered.

I would sink the case A, fig. 3, 15 inches below the ground, and a couple of feet from the side of the tramway. It should be of cast iron, 10 inches long, 6 inches deep, and 6 inches broad, and the pipes B, and C, for conveying the air to the different workings, should be 4 inches in diameter, the valve D, should be closed by a screw, which should be removed so soon as the stop valve, E, both made of brass, is shut to prevent the air in the pipes passing beyond the working then being ventilated, and thus concentrating the whole body conveyed through them to that locality where an accumulation of gas is discovered. But when the balloons indicate no danger, then the workings should be ventilated by this mode in rotation, commencing first with that most distant from the shaft.

The cases should be protected by sheet iron doors, which should be always shut, except when in operation for ventilating the workings they are placed in.

In 1853, Lord Carlisle stated in the House of Commons, that the casualties by coal pit accidents, did not exceed 100 per annum; a very great error by one coming from a coal district. He also eulogized the Belgium management of Collieries under the impression that the casualties were less numerous. Now in 1843 I read a statistical report on the Belgium Collieries, which stated that in the twelve preceding years, the loss of life by coal-pit explosions amounted to 1,200 killed during that period; the number wounded was not stated. In 1857, the *Times* stated the number of casualties from coal-pit explosions in the United Kingdom for the six preceding years at 5,000 killed and 19,000 wounded. If then, the number of miners in each country be in a ratio with the produce of coals, which in the United Kingdom amounted in 1859 to 64,000,000 tons against 8,000,000 Belgium, it is evident the difference in the number of killed is so very small as to need no further comment. It must be observed too that the Davy-lamp has been in use in Belgium from the period it was first introduced in England.

It is to be hoped that all the lamps called safety lamps, will very soon be severely tested, before a Committee of the House of Commons, by three or four scientific men, for they are only modifications of the Davy-lamp, wire gauze being used in all of them.

TESTING SUBMARINE CABLES.

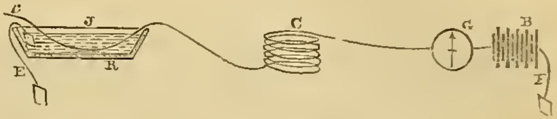
The highly important subject of testing submarine electric cables has been recently minutely examined by Mr E. O. M. Whitehouse, whose name is so intimately associated with the progress of submarine telegraphy.

In the testing of insulated conductors for submarine electric telegraph cables, the mode of procedure has hitherto been to place the battery and galvanometer in circuit between the earth and one end of the cable, the bulk of the cable being immersed in a tank in contact with earth, while the other end is free and insulated. The amount of current passing through the instrument has been regarded as the measure of the "loss" by defective insulation. Or the current thus passing has been compared with that passing through a known and measurable resistance by means of some Rhœostatic arrangement, and thus the resistance of the cable, as it is termed, has been determined.

During the manufacture of submarine electric telegraphic cables, as mile after mile is added to the length previously made, great care has always been required to make a sound "joint," as it is called, in the insulating covering at the point of junction; and it has been the invariable practice, Mr Whitehouse believes, after such joint has been made, and before it is allowed to be covered with the outer iron wires of the cable, to test it by immersion in a pail or trough of water in connection with the earth. Careful observation being made at the time to detect if any increase become apparent in the current entering the cable.

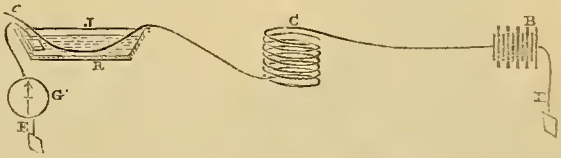
So long as the entire length of cable under examination does not exceed a few miles, the detection of a very slight degree of fault at a "joint" is quite possible, and even comparatively easy. But on examining lengths of cable approaching to or exceeding 100 miles, where the minute increase of loss due to the joint is merged in the largeness of the total amount of leakage, it becomes impossible, with the utmost care and delicacy in this mode of testing, to determine whether the joint in question (which may be 8 or 10 inches in length) give 50 or 100 times, or even 1000 times as much loss as an equal length of perfect cable should do.

Fig. 1.



A degree of imperfection which must thus inevitably pass undetected may ultimately most seriously endanger the safety of the whole cable. This is more particularly the case in long cables, where at the same time the greatest amount of property is at stake; for it is demonstrable that while on the one hand the longer the cable the greater is the necessity for the highest attainable degree of insulation; on the other, it is precisely under these conditions that it has been heretofore impossible, by the accredited mode of testing, to detect degrees of imperfection at the joint which yet would sooner or later entail the certain destruction of the cable.

Fig. 2.



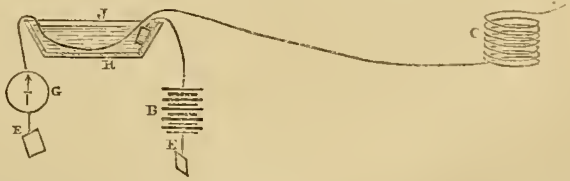
By Mr Whitehouse's improvements, which we shall now describe, it becomes as easy to detect and measure the slightest appreciable loss upon a joint made in a cable one thousand miles in length, as it would be if the joint in question were a short specimen detached for the purpose of testing.

An examination of the simple plan of the circuits annexed will show that the principle of this invention is to separate the current lost at the joint from the sum of that lost upon the rest of the cable, and to examine it by the use of a separate instrument.

This is most simply effected by insulating the trough or reservoir into which the joint is plunged for testing and conveying the current (so caught) through a very sensitive galvanometer to earth.

Figure 1 of the accompanying engravings represents a diagram of the circuits in the old mode of testing. B, is the battery, one pole being connected with the earth by the wire and earth plate, E, the other pole being attached to the galvanometer, G, through which the current passes to the cable, C, the joint, J, of which to be tested is immersed in the reservoir, R, which is connected with earth by an earth plate and wire, E¹; *c*, is the free, insulated end of the cable. Figure 2, annexed, is a plan of the circuit for the simplest form of testing, adopting this improved principle. B, the battery; C, the cable in contact with the earth; *c*, the free and insulated end of the cable; E and E, earth wires; R, a reservoir

Fig. 3.

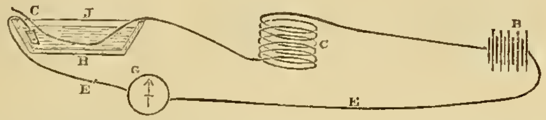


containing water, mercury, or other conducting fluid; J, joint; G, galvanometer. Figure 3 is a plan of the circuits inverting the direction of the current which will now pass from the insulated reservoir to the cable, through the joint, and thence out by the conductor, through a galvanometer, to earth. Figure 4 is a plan of the circuits in which the earth wires may be joined across direct from the insulated reservoir, through the galvanometer, to the battery, instead of being carried to earth plates as usual.

In all these, the principle is that of testing the loss at the joint or part examined, separately from that existing on the rest of the cable.

If it be desired to test in other well-known ways—as, for example, by the differential method; by resistance tables, or Rhœostats; by Wheatsone's bridge, or by electric tension, or in any other method, the plan of the circuit will of course, to some extent, be correspondingly altered in detail, as will be well understood by electricians; but whatever be the mode adopted, the improvement, which is equally applicable to all, is essentially the examination of the loss (or escape of electricity) at the suspected part, as it were separately from the rest of the cable, by such arrangement of the circuit and instruments as shall permit of such examination apart from the aggregate of the loss existing upon the rest of the cable.

Fig, 4.



A less perfect mode of applying the same principle, but still a manifest improvement upon the present mode of testing joints, would be, by the use of a wetted cloth, or damp sand, or some similar material, with which to surround the joint; this would be then laid upon an insulated slab, instead of the trough, the connections and circuit remaining as before.

THE FEEDING OF BOILERS WITH HOT AND COLD WATER.

VI.

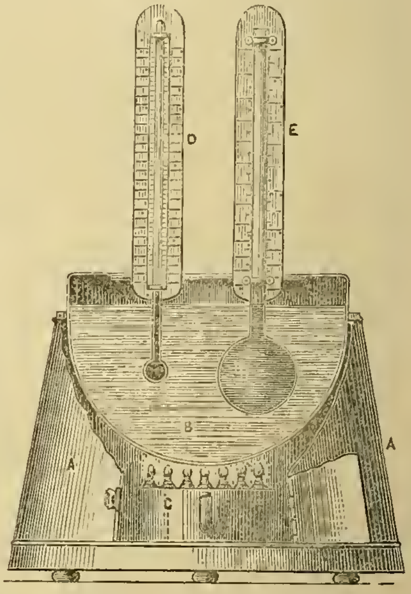
In my last I stated that it was clearly indicated from experiments that a greater amount of heat was required to raise the pressure from water which had been previously boiled, in consequence of the air being partly expelled. This was observed from the following experiments. The annexed engraving, fig. 10, will convey an idea of the apparatus used. The semi-circular boiler, B, was nearly filled with linseed oil. The brass thermometer, referred to in my last paper, was filled with water. The oil in the boiler was first heated up to 310°, by the lamps, C. At that temperature the lamps were extinguished. The instant that the mercurial thermometer in the oil indicated 300° when falling, the brass thermometer—having previously been filled with water at a temperature of 54°—was immersed in the oil, and as the water ascended in the stem of the thermometer, its expansion was marked at every 20°; and the instant the water indicated contraction, the time and the degree of heat on the mercurial thermometer were observed. The contraction of the water was indicated when the mercurial thermometer was indicating 210°, and the time occupied was 14 minutes. This experiment conveys to us a clear idea of the measure or quantity of heat absorbed in expanding the water to the points indicated on the scale. The water thermometer was again cooled down to its former temperature of 54°, and the oil raised to 310° as formerly, and the lights again extinguished; and the instant the oil indicated 300° when falling, the brass thermometer was again immersed. The time occupied was 14 minutes, 30 seconds, and the expansion was 3° less than the former experiment. The process was repeated a third time, when the indications were proportionately less From this it seems clear that a greater amount of heat would be required to raise pressure from water that had been previously heated to the boiling point, than water in what may be termed its natural state.

The question may now be asked, Should the feed-water supplied to the boiler be heated? We say, yes. But to what degree? On referring to the February number, it will be observed on the chart representing the water-lines of heat that the first lamp raised the heat of the water from 50° to 120°. If the water be heated to 120° or 140°, that would be attended with considerable advantage, as in the different experiments made with the water thermometers I observed that very little of the air was expelled from the water within those degrees of temperature, but at higher temperatures it passed off very rapidly, particularly from the water in the brass thermometer. It may be said, Why not supply the boiler with forced air? From experiments this is not advisable, for I have found when air was pressed into the boiler, that on allowing the steam to escape, the water in the boiler began to prime or boil over—an effect at all times to be carefully avoided. It certainly seems strange that there is not a greater amount of saving when the feed-water is heated to 212°; but when we take into account, first, the air being expelled, and second, the amount of energy or heat required to sustain the vapour or gaseous condition, it seems to be very different from that required to raise the water to the boiling point. This will be evident by referring to the chart engraving of the heat lines before referred to. This engraving conveys to us an idea of the amount of heat required to maintain water at the boiling point. The cover of the boiler being removed, the base-line, A, represents the degrees of heat, and the circles represent the degree at which each lamp was applied, the time in each case being equal, and the curves represent lines of heat. It will be observed that the first lamp raised the temperature to 112°, that the fourth lamp only increased the temperature 15°, and that the fifth lamp was required to sustain the boiling of the water. It seems evident that to raise the water to 130° or 140° would be a saving, so far as indicated by experiment; but to raise the heat of the feed water to 212° would not, we think, compensate the expense of doing so, although viewing it theoretically it would appear to be a great saving. But where practical experiment can be applied, theory ought to form no part of the question.

This view may not be favourably received by many, but I have offered nothing but what seems clearly deducible from experiments, and those who doubt may test. We know that the first expansion of the metals is the greatest—that the first discharge of the battery is the strongest; and it seems clear that the first energies of the water are the most powerful. We know that agents of energy are possessed of a certain amount of power; and our study ought to be, the best means of its application when we can form an idea of its extent. At the present time there is a run to the extreme points of pressure, which dear-bought experience will, in course of time, correct.

It seems to be a law, clearly indicated, that all bodies are calculated to give out a certain amount of energy, and then reconstruct, and again give forth energy. This we daily observe in the combustion of wood and coal, which gives forth energy, and again forms new combinations in the great laboratory of nature, where nothing can fall to waste, but simply undergo changes, so that that which at one time appeared the fruitful tree, as time passes on, changes, and reconsolidates, and forms the solid mineral, and again comes forward as the carbon coal, to give energy, and then pass in cloudy smoke, again to be reconstructed.

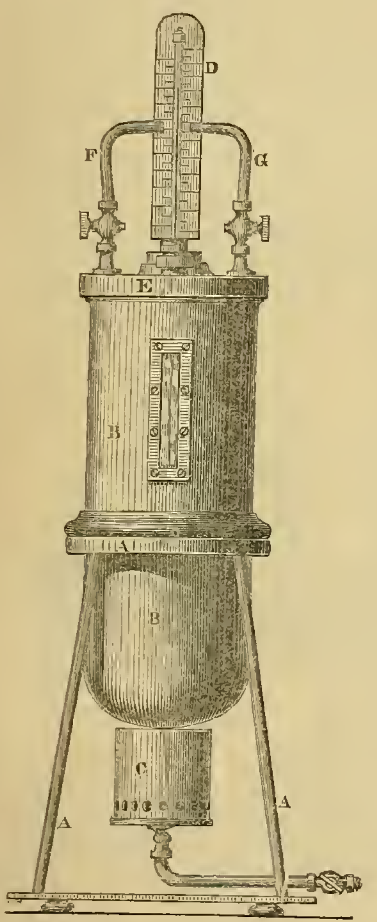
Fig 10.



Energy may be represented by a series of lines, either parallel, converging, or diverging. These lines may be viewed as lines of force; and whatever body is calculated to impede their course, gives that energy or force a direction depending on the form, position, or construction of that mass or body. The forces from vapour may be viewed either as parallel or diverging. That we may more clearly perceive this, let us suppose two jets of steam or vapour opposite to one another, the stop-cocks to be opened, the forces of the vapour or steam that would pass from each would thus equalise each other without motion being produced; but if either of the jets be inclined from the parallel line, motion follows as a consequence; and if one of the jets be closed, motion equally follows. From this it will be apparent that these laws apply to the cylinder and piston of the steam engine, with this difference, that the vapour within the cylinder partakes of a diverging energy, that is, the force is acting in all directions while it is giving motion to the piston.

A question now arises, ought the heat of the cylinder to be greater than that of the steam expending its energy within? May not the condensed vapour which is formed within the cylinder be reinduced to give a counteraction to the ascending and descending piston, and thus impair the effective power of the engine? When we come to treat of the steam engine and its construction, we shall have occasion to refer to this more particularly. My reason for referring to it at present is, that when experimenting with two jets of steam in producing power at different angles, and again cooling and heating the condensed vapour, it seemed to produce a reaction in the forces. The engraving, fig. 11, will convey an idea of the apparatus I used for carrying out further experiments and observations. The stand, A, is for supporting the boiler, B. On this boiler there are two windows, the one opposite the other, three inches in length and six-tenths of an inch in width, so that the action of heat on the water can be clearly observed. C is a gas lamp for supplying heat; D is a thermometer for indicating the temperature. On the cover, E, are two stop-cocks, F and G, having tubes attached, which can be set to any angle, so that the power may be indicated. Suspended within the boiler there was a magnetic needle which was sometimes above and at other times below the surface of the water. My first experiments with this apparatus were to observe the effect of the gradual increase of energy upon the water at the different points of pressure. The effect of heat upon the water was beautifully indicated when observed through a strong magnifying glass. The incessant motion I cannot well describe: as the pressure increased, it showed incessant curling clouds, ascending to the surface in myriads of atoms, and again descending. At a pressure of thirty pounds the transparency became greatly dimmed, from the rapidly increasing motions and instantaneous shootings of the atoms; and when the stop-cock was instantly opened the water became quite opaque, its transparency being for the time entirely destroyed. When the water was reduced so as to occupy an equal amount of space with the steam, and the stop-cocks quickly opened under a pressure of 30 pounds, the water contained in the bottom of the boiler seemed all to rise instantaneously and fill the whole steam space. When the cocks were instantly closed the water again descended to the bottom. This experiment I have repeated many times, with the same results, and at each time the water seemed equally to loose its transparency. It would seem evident from this that during the time the water occupied the steam space, that the water and steam were in their relations mixed together; and that during this time the bottom of the boiler was exposed to the intense heat of the flame. May we not infer that when this takes place with boilers from a rend occurring through the weakness of some particular part, or from the instant opening of a large safety valve, the equilibrium of the vapour and fluid being for the time deranged, and a partial vacuum formed, the water falling back over the intensely heated surface, and the instantaneous reaction taking place, that this is one of the primary causes of boiler explosions? We are assisted in this view when we examine the great natural causes which produce the hurricane and thunder-storm. Previous to the bursting or breaking out of a violent storm, there is a still heavy stupor, which affects for the time all animated nature, then comes the electric flash, which produces a partial vacuum in the air, followed by the roll of thunder, then the elevation and depression of the waters begin to roll onwards to the point of greatest heat; meeting at this point, a vortex is formed, and at each explosion the water rises and descends in whirlpools, and the wind carries destruction to all bodies which impede its course. The relation of these effects to the priming and bursting of steam-boilers may be reasoned on similar principles. Let us suppose the water in the boiler to represent the sea, and the steam the atmosphere. The instant a rend is made, or a valve opened in connection with the boiler, a partial vacuum is formed at the point, and the pressure of the steam on the surface of the water—the balance being destroyed—the water is compressed to the point where this partial vacuum was formed by the opening of the steam valve, so that the water instantly follows, the quantity depending on the pressure of the steam.

Fig. 11.



The magnetical effects we shall have occasion to refer to in our next.

PAUL CAMERON.

RECENT PATENTS.

ROTATORY ENGINE.

RICHARD A. JEFFERSON, AND MATTHEW JEFFERSON, *London.*—*Patent dated March* 31, 1860.

This invention consists of a novel construction of rotatory steam engine, and relates principally to the manner in which the slides are fixed to the covers, and the form of the cylinder rendered necessary to work therewith, there being four slides passing through the covers and meeting together within the cylinder, two and two alternately, forming steam-tight abutments, also two lateral cams, fixed on the central axle to withdraw and replace the slides, and the arrangement of the brasses for keeping the axle permanently in its place, by which combination is obtained an engine of a nearly uniform power, in all positions of the piston, and without any loss of steam.

In the accompanying engravings, fig. 1 is a vertical section parallel with the plane of rotation of an engine constructed according to these improvements. Fig. 2 is an end view of the axle, hub, and piston, with the entrance and exhaust for the steam. Fig. 3 represents an adaption of the same invention, in which only two slides are employed. Fig. 4 is a side view of the friction wheels and cam for the same. A, is the cylinder, the periphery of which is of the form of portions of a circle struck from the centre of the hinges of the slides, as shown in Fig. 1, the ends or covers, *a*, being contracted towards their centres, leaving a steam channel somewhat of a triangular form; in each cover, *a*, are two slots radiating from the hub on the axle to the periphery of the cylinder—on the covers are also the stationary parts, *e*, of the hinges; they may be cast with the covers, or fixed thereto. B, is the hub keyed or cast on firmly to the axle, F, its thickness is regulated by the breadth of the cylinder and the depth of the slides; its form at its periphery is immaterial, if the slides be made to fit it when they are within the cylinder. To the hub is fixed a piston, which in fig. 1 occupies the space marked P. C and *c*, are four slides, each slide is fixed to or may be cast with the half-circular piece, E, the ends of the half circle, together with the projections, *e*, on the covers, form the hinges (they may be placed nearer to or farther from the hub, if the other parts are arranged accordingly); they are of great strength, having to bear the entire force of the steam when the abutment is formed, and are wide apart, to ensure steadiness. F, is the axle, it is hollow from the ends to the hub, a portion of the axle being left solid. Two holes are made in the hub, B, one on each side of the piston, marked O, having connection with the hole in one end of the axle, and *o* with the hole in the other end. D, represents two lateral cams fixed on the central axle and rotating with it; these cams are formed of a single plate, one-half of which is at right angles with the axle, the other half is dished outwards from the cylinder, they are placed between the hinges, but they may be placed otherwise, as in fig. 3, and connected to the slides by rods—these cams may be either with a groove on their periphery to receive the blocks, or with a plain edge and the blocks lapping over each side. The blocks marked *d*, fig. 1 are attached to the tops of the half circles of the slides, and are fitted on pins to allow them to give to the form of the cams, (if fitted with friction wheels the pins may be dispensed with.) The axle passes through the ends of the cylinder and is supported in bearings, G, in two standards, Y; the brasses are divided into three or more pieces, and are of the form of wedges, the part which lies to the standard being flat, the thick ends project without the tapered space in the standards, and over them is a plate, T, fig. 1, with four screws, which, when tightened, force

Fig. 1.

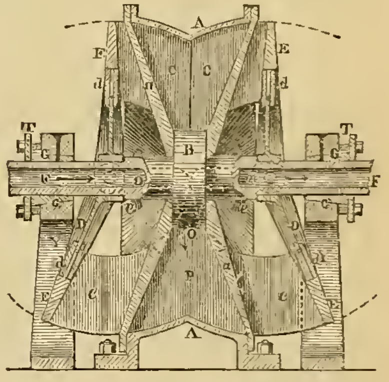
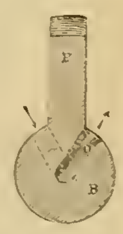


Fig. 2.



them inwards, and contracting on the axle, keep it firm, the spaces in the standards are tapered inwards towards the axle, and left square, the brasses being also square to fit. In fig. 3, which is a plan of an engine of the two shutter kind, H, is the principal standard and back plate; it carries one set of brasses, and has the cylinder, A, screwed to it. The cam, n, is removed further from the cylinder and placed outside the other standard, Y. The friction wheels, J, are fixed in two frames, Z; one end of the frames are attached to the slides by a broad piece forming a hinge, the rods at the other ends of the frames work through guide holes in the standards, N. The friction wheels and the formation of the hinge is shown plainer in the side view, fig. 4; J, being the friction wheels, Z, the frame, n, the cam, F, the axle, E, a portion of the half circle, and C, the slide attached to the frame by the hinged joint, S. To ensure the perfect formation of the abutment it may be requisite that the edge of the slide, or one of the slides when two are used to form an abutment, be made with a groove to receive a piece of packing which projects slightly beyond the edge of the slide, kept outwards by springs and prevented from falling out of the groove by two pins or rivets. Supposing the rivets are firm in the slide, the hole in the packing through which they pass must be slotted, so that when the slides meet together the packing adjusting itself to the edge of the other slide is pressed within the groove. The various parts being packed steam-tight, the action is as follows. The slides, C, being within the cylinder, and the piston at P, fig. 1, the steam enters through the axle, F, and through the hole, O, in the hub, it there exerts its force against the slides, C, and the piston, and the piston makes about one-quarter of a turn, the cams, n, having during that motion placed the other two slides C, within the cylinder, and the hole, O, being behind the piston, they now bear the pressure, and the piston makes half a turn, during which time the cams have withdrawn the slides, C, allowed the piston to pass, and replaced them again. As soon as the cams commence to open the slides, the steam rushes between them and through the hole, *o*, which is before the piston, through the other end of the axle either to the condenser or escapes to the atmosphere. From the time the abutment is broken until it is again formed, the slides have no weight of steam on them, consequently there is little wear or friction on the hinges. To reverse the engine, the patentees use a four way cock, or some such contrivance, as it is only necessary to pass the steam to the other side of the piston; the engine may be stopped and set again in motion, in any position, there being at all times an abutment formed. When the invention herein described is to be used as a pump, the arrangement will be the same, making the injection and ejection ways as large as possible, and driving it by a pulley fixed on the central axle.

Fig. 3.

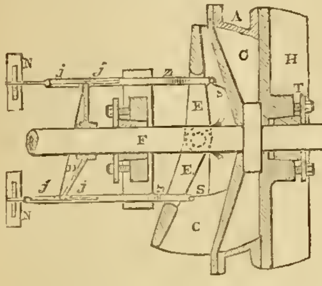
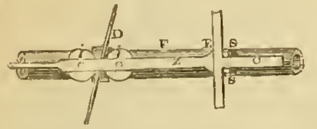


Fig. 4.



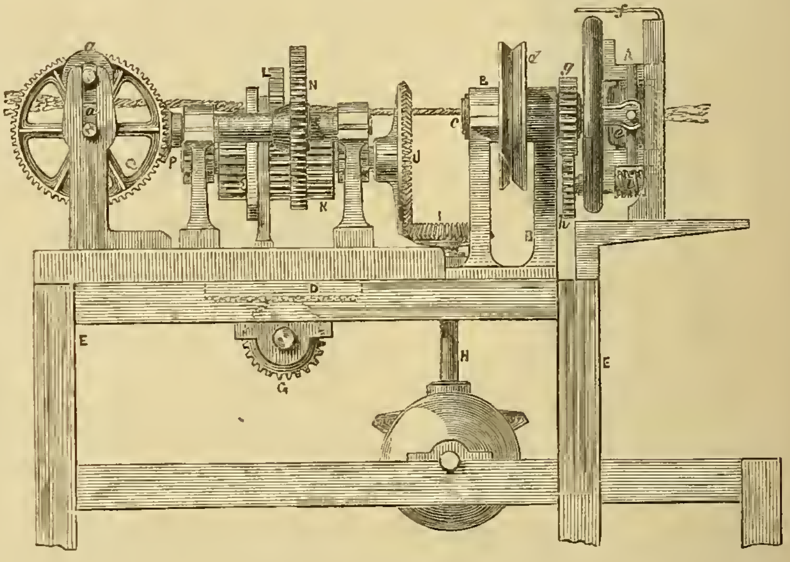
SPINNING MACHINERY.

J. H. Johnson, *London and Glasgow*, (Edmund Victory, *Watertown, New York*).—*Patent dated May* 22, 1860.

Under these letters patent is specified a peculiar construction and arrangement of certain parts of machinery or apparatus employed in the first or preparatory process of spinning, known as roving, and has for its object the regulation of the actions of the feed and drawing rollers in relation to each, without necessitating the stoppage of the machine. The present improvements are applicable only to those roving machines wherein the sliver is simultaneously drawn and twisted by the action of a rotatory draw-head, provided with drawing rollers that not only revolve on their own axes to effect the draw, but have also a general rotatory motion in connexion with the draw-head to produce the twist.

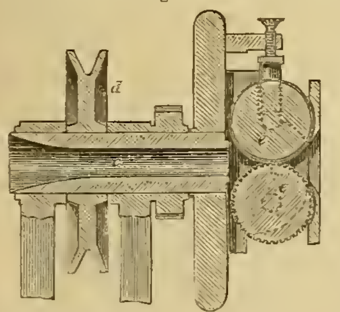
Fig. 1 of the accompanying engravings, represents a side elevation of a roving machine with the present improvements applied to it. The wool or other fibrous material, is first passed through ordinary or any other suitable feed rollers, *a*, the lower one of which may be fluted and made to receive a positive motion by suitable gearing, whilst the upper one may be covered with leather, and hung so as to rotate freely and be held down to exert a necessary pressure by springs. This is an ordinary construction of the feed rollers, and for conveying or guiding the slivers to the draw-head, and for supporting such slivers when in continuity and being rove, for which purpose the line of junction of the rollers is usually in a horizontal plane coincident with, or crossing at a suitable distance from it, the tube, *c*, of the draw-head, which is shown more clearly in section in fig. 2. A general rotatory motion is communicated to the draw-head, A, by means of a cord or band from a drum below and passing round a pulley, *d*, fast on the draw-head tube, *c*, or it may be driven in any other suitable manner. The drawing rollers, *e*, receive a general rotatory motion in common with the head, as they are carried by the latter. In addition to this, the said rollers (which are or may be situated as in other draw-heads, and be of any well known or suitable construction), have a separate motion on their own axes, or are made capable of such independent rotation, as previously alluded to; but according to this invention, they are driven in a novel manner, and the draw-head itself is made to partake of certain peculiarities of construction. Thus, the draw rollers or the one *e*, which is driven, and which may, as usual, be fluted, whilst the other roller may be covered with leather, and hung so as to rotate freely under pressure of a spring, *f*, and is not dependent for its individual rotation upon distinct driving mechanism, but is made of necessity to rotate separately in proper relationship to the general motion of the head by causing it to derive its rotation as well as its general movement with the head from and by the motion of the latter. This is here effected by means of a stationary circular rack, *g*, into which a toothed pinion, *h*, is made to gear, and round which it travels by the general movement of the draw-head, this pinion being made fast to a spindle in the rotating draw-head, which spindle carries at one end a screw, *i*, that gears with and drives a pinion on the draw roller, *e*. The circular stationary rack, *g*, is constructed in two parts, or halves, and one of these parts is cast in one piece with the cap, B, of one of the standards which carries the tubular shaft, *c*, of the draw-head, the other part of the rack being cast on, or secured to the standard itself, so that by simply turning the head to bring the pinion, *h*, to a downward position, or out of the way of the standard cap, and by detaching the caps from their standards, the draw-head may be lifted out when required, for repairing or cleaning. The speed of rotation on their own axes of the drawing rollers, *e*, should of course be faster than that of the feed rollers, *a*, in order to produce the necessary draw on the slivers as they pass from the feed to the drawing rollers, and are twisted as well as drawn by the rotation of the head and separate revolution of its rollers, as hereinbefore described, and are delivered in the form of rovings in the rear of the machine, after passage through the eye or tubular shaft, *c*, of the draw-head. The feed and drawing rollers should have a fixed or set speed relatively to each other. The distance between these two sets of rollers, however, should be variable, to facilitate the spinning of fine or coarse wool, or whatever the staple may be, and to

Fig. 1.



meet other requirements or peculiarities. Thus, by increasing the distance between the feed rollers, *a*, and the draw rollers, *c*, more draft will be produced, and the roving made thinner or reduced accordingly, whilst, when coarse roving is required, then the distance between the feed and draw rollers should be reduced. This will be clear when it is considered that the feed being the same in each case, and supposing the draw head and its rollers to have a fixed speed, there must of necessity be more twist per foot given to the slivers between the feed and draw rollers, in proportion as these sets of rollers are brought nearer to each other, and consequently, a more compact and stronger roving will be produced. Of course, if desired, provision for varying the speed of any one or more of these several parts may be made. In connection with this portion of the invention, there are other important considerations; for instance, in working wool, it must be remembered that the nature of the staple varies both in length and coarseness or strength of fibre. Generally the coarser the wool the longer the staple, and the finer the wool the shorter the staple. It should also be remembered that the draw rollers in all cases travel faster on their own axes than the feed rollers, in order to produce the draft; consequently, if the fibre of the substance to be rove be long enough to reach and be held simultaneously by both the feed and draw rollers, a strain will be exerted upon it, which will cause it to break and occasion frequent or a constant recurrence of breakages, and necessitate continual stoppages of the machinery. This, however, may be avoided by increasing the distance between the feed and draw rollers, so as to make it impossible for both sets of rollers to have hold at the same time on the same fibre, and so as only to grip on a continuity of fibres. It is important, too, to prevent stoppages of the machinery, and breaking of the fibre, that this adjustment of the distance between the feed and draw rollers should be capable of being made during the operation of roving. To effect this, the feed rollers, *a*, may be carried by an independent slide provided with a rack, F, that may project through a slot made longer than the rack, in the general table or stand, E. By turning a handle, on the outside, to the right or to the left, the slide with the feed rollers, may be made to approach towards or recede from the draw rollers, the shaft on which the handle is fast, carrying a pinion, G, that gears into the rack of the slide. A convenient mode of driving the feed rollers to meet this adjustment, is to communicate power through suitable gearing, to a vertical shaft, H, which in its turn may be made to drive by bevel wheels, I J, a toothed cylinder, K, of sufficient length to provide for the extremes of adjustment of the feed to the draw rollers, and which cylinder has gearing into it a pinion, L, carrying on its shaft another pinion, which gears with a wheel, N, on the shaft of which is a bevel pinion, P, gearing into a bevel wheel, Q, on the shaft of the feed roller, *a*. A shield is placed in front of the draw-heads for the purpose hereinbefore mentioned. It is of a circular form, and of a sufficiently large diameter, to entirely cover and protect the draw rollers, and is sunk or slightly funnel-shaped towards the centre, where a hole or opening is cut, fitting as closely as possible to the surfaces of the draw rollers, without being in actual contact therewith. In order that the operation of the draw-head, in connection with the shield, may be fully understood, it may be observed that the sliver, after being delivered by the draw-head, is received on to a bobbin carried by a revolving spindle, to which as great a speed is given as the resistance or strength of the material will allow of. The strain on the twisted and drawn sliver being constant, and the sliver itself varying in strength at different parts, it occasionally happens that the sliver becomes broken between the draw-head and the spindle. When this occurs, it is necessary in draw-heads of the ordinary construction to stop the running of both the spindle and the draw-head, for the purpose of uniting the broken ends of the sliver, and those particularly for preventing the upper loose end in the draw-head from becoming entangled with the rollers and gearing. By adopting a shield, as above described, it obviates these objections, as in case of a breakage of the sliver, it can be pierced or jointed without stopping any of the working parts; whilst the peculiar formation of the disc or shield effectually prevents the loose end of the sliver from getting entangled with the draw-head. The several draw-heads of the machine have a plate or fender, common to all, placed in front of them, and this plate has circular holes cut in it, corresponding to the several shields, which fit and rotate therein. The top of this plate or fender is extended back horizontally, as shown, thereby protecting the draw-heads from the sliver, should it be thrown over from above, or from one draw-head to another. In the arrangement we have described and illustrated the feed and draw rollers rotate on their own axes at a certain invariable speed in relation to each other, there being no arrangement shown for increasing or diminishing the speed of rotation of the draw-head upon which the draw rollers depend for both their movements; but the patentee describes an arrangement, whereby the speed of the rollers can be changed in relation to each other very simply.

Fig. 2.

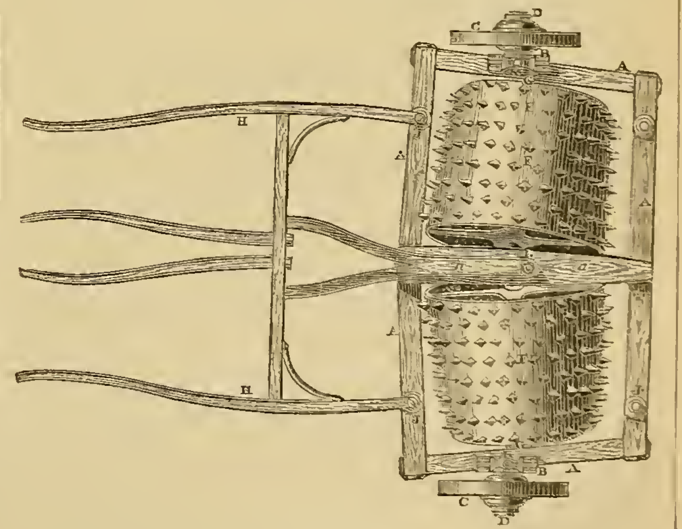


CRUSHING AND SCARIFYING MACHINE.

James Braby, Jun., *London—Patent dated June 19, 1860.*

The machine which forms the subject of this invention, consists principally of two rollers, with conical or curved surfaces, the peripheries, circumferences, or surfaces of which are furnished with projecting teeth, tines, or analogous instruments, which, as the cones or rollers rotate over the road or land, will penetrate or enter and will break up the surface. The form of the projecting teeth, tines, or instruments, must depend upon the particular use for which the machine is intended to be employed. The axles of the rollers are set at an angle to each other, as well as to the surface of the ground, so that the projecting teeth or tines, when they penetrate the surface, will tear it up. For the convenience of transporting the machine from one place to another, and also to admit of regulating the depth to which the projecting teeth or tines shall penetrate the surface, the machine is mounted on a pair of running wheels, provided with adjustable bearings and elevating screws, or other equivalent contrivances, whereby the rollers or cones may be raised up or let down at pleasure.

Fig. 1.



The accompanying engraving, is a plan view of one of the machines. A, represents the framework of the machine, which is provided with bracket bearings, B, for the purpose of receiving the axles of the running wheels, C. These axles are formed of studs, D, projecting from the adjustable blocks, which are capable of moving up and down in the brackets, B. The rollers, F, which are shown as made of a conical form, and constitute the principal feature of the invention, are armed with strong teeth or spikes, and are mounted by their studs or axles in an oblique direction in suitable bearings, G, attached to the framework. The axles of the tine rollers are set at an angle to each other, and they are also set at an angle to the surface of the ground, so that their lower sides may rest thereon. When the machine is in use, it is drawn over the surface by the power of two or more horses, which are harnessed in the shafts, H, at the hinder end of which is a central tug bar, *h*, provided at its extremity with an eye or socket, which passes over a vertical stud, L, fixed on the centre bar, *a*, of the framing. The inner ends of the outside shafts are also provided with eyes or sockets, through which pass vertical pins or studs, J, whereby the shafts are secured to the front bar of the framework, A. The shafts are capable of being turned round on the central vertical stud, L, and may be brought round and secured in the required position by transferring the pins or studs, J, from one bar of the framing, A, to the other, so that the machine may be drawn forward in the either direction, or in opposite directions alternately. In order to raise the spiked rollers from the ground when they are not required to act thereon, as when the machine is being transported from place to place on the running wheels, the blocks, E, which carry the axles of the running wheels, are made moveable up and down in guides formed in the brackets, B, and are provided with screwed shafts, K, which pass in front of the framing and through sockets in the arched top of the bearings, B, in which the adjustable blocks are supported. The adjustment of the running wheels is effected by screwing or unscrewing the nuts and jam nuts, as is well understood. The conical rollers, shown in the engraving, rapidly decrease in diameter from the larger to the smaller ends; but the patentee sometimes considerably reduces this conicality, and for some purposes finds it preferable to make the spiked rollers nearly cylindrical, but their axles must always be set at an angle to each other, so that when working on the ground their spikes or teeth may have a tearing or digging action.

PRINTING AND EMBOSSING MACHINE.

Charles L. Davies, *London.—Patent dated August* 7, 1860.

This invention relates to improvements in machinery, principally applicable for printing and embossing address and show cards, as well as other similar articles.

Fig. 1 of the accompanying engravings, represents a longitudinal vertical section of a machine complete, for printing and embossing address cards and other articles according to this invention. Fig. 2 is an end view corresponding to fig. 1; while fig. 3 represents a detail of one modification of the printing cylinder and inking roller, to be hereinafter referred to. A, is the chamber or receptacle into which the cards are to be placed previous to printing; the cards fit the chamber somewhat closely, and so as to keep them in proper position superposed on each other, and free to descend therein for the feed or supply while printing. This case is fitted with a catch slide, G, which slides along the bottom of the case to a certain extent, and recedes into a small chamber, C, extended rearward, forming a case to receive it, the backward movement being performed till the small step, 1, is just beyond the ends of the cards in the case, the shoe part, 2, being under the end of the lowest card at this time. A slot, D, is provided at the opposite end of case, A, of a suitable width to permit the card to pass, as also of sufficient depth for free passage of the lowest card, but such as to prevent the escape of the one above it also. The slide, G, has a reciprocating motion imparted to it in the one direction, to draw out the card by means of the side bars or connecting rods, E, actuated by the printing cylinder, and in the reverse direction by means of springs at F, which draw the slide, G, backwards rapidly, and in readiness to take hold of the next card in succession. The rods, E take on to studs or pins of the slide, G, and work through guides, H, fixed on the side of the box, A, which control the position and limit the rise and fall of the rods, E, they being at all times raised by slight springs, K. The springs at F, are also attached at one end to these studs at G, and at the other to pins, I, fixed to the rear part of the case, C. L, *l*, are standards carrying the printing and embossing part of the apparatus. It consists of a cylinder, M, having a type or other surfaces in relief arranged on it as desired to be printed; it is mounted in movable bearings, N, pressed down by screws so as to force the printing roller down with greater or less force on the roller, P, receiving the pressure, which is of wood or metal covered with india-rubber, or other suitable material, to receive the pressure of the type or other printing surface in making the impression on the card. The ends of the plain cylinder bear against the enlarged ends of the printing cylinder, and thereby at all times regulate the pressure on the type or printing surface. Q, R, S, are the inking rollers, R and S having surfaces of composition, as is usual for such purposes. These rollers are mounted in bearings carried by the extensions, *l*, of the frames, L, in which the two upper ones are free to rise and fall, and are pressed down and regulated, as may be required, by small screws, U. The upper roller, Q, which is of wood or metal, is in contact with the ink contained in the chamber, T, there being no bottom to that receptacle where the roller abuts on it, and travelling in the direction indicated by the arrow, any excess of ink taken up by the roller, Q, is scraped off by the doctor, V, and retained in the receptacle, T, the roller, Q, turns in close contact with the roller, R, and, therefore, transfers a greater or lesser amount of the ink on its surface to roller, R, and this again in like manner to the roller, S, which is in contact with the printing cylinder, M, the whole three being driven by rollers, *q*, *r*, *s*, covered with elastic material, and fixed on the axis of the inking rollers, which are in frictional contact with the marginal ends of the roller, M, and their frictional contact with each other. The ink thus taken up by the roller, Q, becomes properly regulated and distributed before being transferred to the type or printing surface, as is well understood with reference to printing machines. It will be observed that the inking rollers are of a breadth less than the distance between the plain or marginal ends of the printing cylinder, M, so as to avoid inking those surfaces. The rods, E, before mentioned, have each a notch, W, and on the ends of cylinder, M, are projecting studs or pins, X, which, at each time they come round by the revolution of M, take simulaneously into the notches, W, and pull the rods, E, and with them the slide, G, thereby projecting the card at the slot, D, before mentioned, and as represented at fig. 1; the card so projecting is nipped between the marginal ends of the cylinder, M, and the plain cylinder, P, and is carried through between those cylinders and delivered in front, and so receives on one side the impression of the type or printing surface. Immediately the card has been pinched between the cylinders, and a proper hold taken of it, the pins, X, release the notches, W, by reason of the shape of the pins, which are semi-cylindrical; so long as the flat part of X, has hold of the notch it is retained, but the revolution of the cylinder, M, causes them to turn the round parts into the notches, which slip therefrom, and start back by reason of the force of the springs at F, as before explained, the slide, G, taking up its position to discharge another card at the succeeding revolution of the cylinder, M, which is printed as before; in this manner from six to ten thousand cards may be printed in an hour. The apparatus is driven by a winch handle on the axis of the cylinder, M, at a uniform speed. On the inner sides of the chamber, A, there are projecting ribs to prevent the edges of the cards touching its sides throughout; these ribs may be moveable in order to change them for thicker ones, in case of any variation in the sizes of the cards to be printed; in this way the same machine may be used for several sizes of cards. For show cards and other large surfaces of cardboard, or other stiff material to be printed, the machine must, of course, be of proportionate size, and a printing surface, M, of wood used for the purpose, as indeed it may so in any case, as a boxwood cylinder, M, will answer the purpose for address cards. The slide, G, and rods, E, may be caused to assume their backward position by a spring, *f*, shown dotted, instead of springs, F and K, the ends of the rods, E, being cranked, as shown dotted, to effect the double object of keeping up their front ends and drawing them back at the same time. In using this apparatus for printing and embossing, such may be effected by forming the lower cylinder, P, with metal parts to correspond with the marginal ends of M, formed in relief on the one and hollow in the other, any suitable ornamentation which it is desired to produce by embossing on the card, which will be effected at the same time as the printing. A further illustration of this is shown in fig. 3, which represents the roller, M, as having, in addition to the embossing ends, a surface in the middle of its breadth, for the purpose of embossing the central part of the card; the middle of the roller, P, is similarly furnished with a metal surface, having the raised and embossed surface thereon of the pattern or ornament desired to be produced on the card. It will be observed, that the inking roller, S, is such that it applies no ink to the embossing surfaces. Embossing may be performed without printing in this apparatus, by merely removing the inking rollers.

Fig. 1.

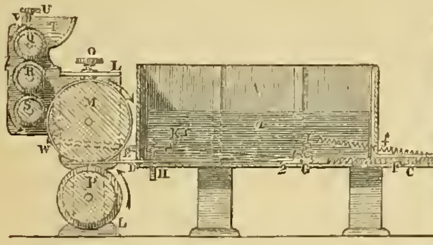


Fig. 2

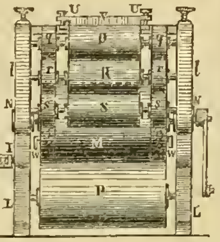
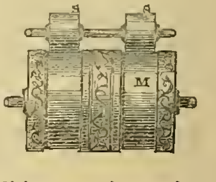


Fig. 3.



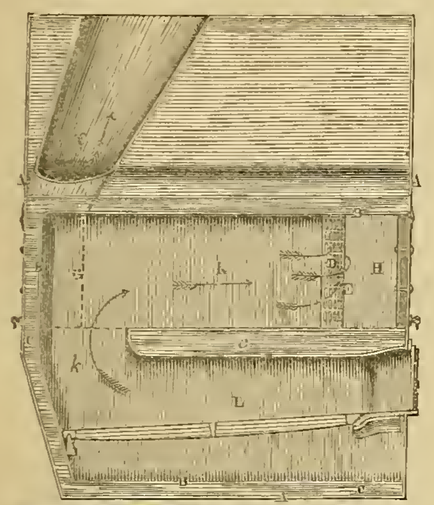
STEAM BOILERS.

John Redfern, *Portsmouth.—Patent dated February* 23, 1860.

This invention relates to multitubular boilers, and is designed, first, with a view of preventing the burning of the tubes, an objection attending multitubular boilers as generally constructed; secondly, in an improved mode of arranging the flues of such said boilers, whereby a much larger area of fire surface is obtained than heretofore, in proportion to the size of the boiler, and the heat from the fire is more effectively employed and utilised therein, thereby economising fuel.

The accompanying engravings illustrate one modification of this invention. Fig. 1 is a longitudinal vertical section, through one of the furnaces and its take-up flue, of a multitubular marine steam boiler constructed according to this invention, with two fire places. Fig. 2 is a sectional plan view of the same, and taken on a line, through the tubes. A, is the outer metal casing of the boiler. B, an inner metal casing, kept at a fixed distance from the outer case by stays in the usual way, so as to leave a clear water space, C, for the passage of water between such said casings, and also around the tubes, D, these tubes are fixed by their ends into upright plates, E, G, the plates being so fixed to the other plates of the boiler, as to leave open spaces at H, between them and each end of the boiler, as exhibited at fig. 2. The inner casing, B, of this boiler, is also so arranged and fixed to the boiler as to leave clear spaces, K, which, with the space at H, constitute flues for the passage of heat from the fire places or furnaces marked L, in fig. 1. The space at I, forms the take-up from the back end of the tube, towards the chimney of the boiler, and to which it is to be affixed or connected according to local circumstances, and the purpose for which the boiler is intended, whether as a marine boiler for ships or boats, or as a stationary or fixed land boiler, or as a boiler capable of being moved from place to place by locomotion. The course of the heat and gaseous vapours from the fuel in the furnaces is indicated by arrows, that is to say, the heat passes from the furnaces under the water space, *c*, from thence up at the openings at *k*, along the side flues or spaces, K, to the smoke hole, H, thence through the several tubes, D, into the take-up, I, and finally makes its exit at the chimney affixed or connected thereto And it is this novel and improved mode of directing the heat through the boiler which constitutes the peculiarity and distinctive feature of this invention. And although the accompanying engravings only exhibit and refer to a boiler having two fire places or furnaces, it will be evident that where boilers of large size are required, several fire places or furnaces may be adapted thereto, by making a greater width at *c*, *c*, occupied by tubes, and thus giving room for more furnaces below. The improved boiler also requires to be fitted with suitable man holes, mud holes, safety valves, water and steam gauges, and other of the ordinary appurtenances of steam boilers, all of which being well known and commonly used with steam boilers, it is unnecessary here to enter into any particular description or mode of arrangement. For the purpose of access to the side flues and tubes of the boiler above described, it is proposed to adapt doors, as at M, either at the front of the boiler, or at the back thereof, or both, as circumstances may require, or convenience admit of.

Fig. 1.



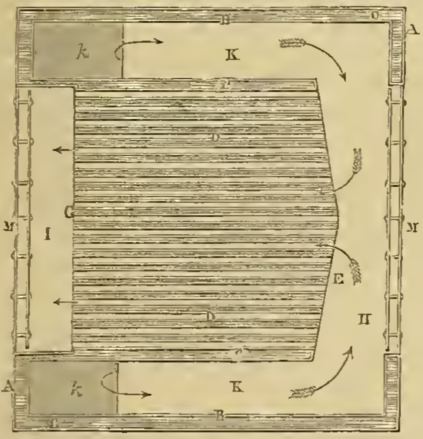


Fig. 2.

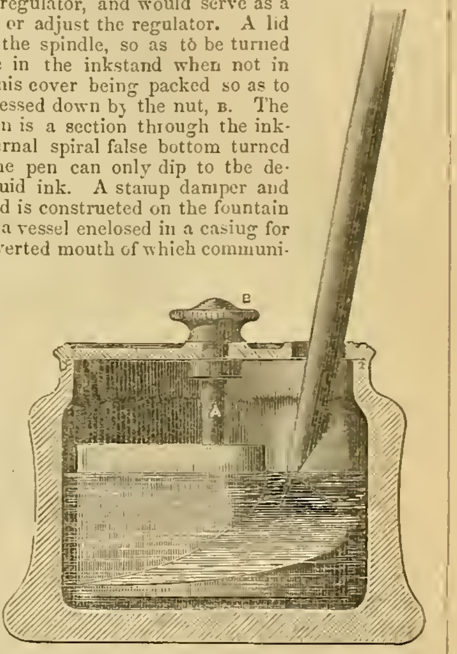
WRITING DESKS.

JOHN GARNETT, *Westmoreland—Patent dated August* 17, 1860.

ACCORDING to one part of the invention, specified under these letters patent, it relates to a new form of writing desk, wherein suitable partitions are placed in the compartment of the desk for holding the pen holders or pencils, so that they may be made to rest or lie one above another, a space being left on each side for the introduction of the fingers in taking them out for use.

The body of the writing case and the lid is provided with a suitable writing pad, or with a tablet of glass, if preferred. The interior of the case is subdivided into two large compartments, one of which is adapted for containing note paper and envelopes, and the other for containing long or business envelopes. The compartment for receiving pen holders and pencils, is provided with four partitions, between which the pen holders and pencils are placed. The vacant spaces left on either side admit of the ready insertion of the fingers when taking out a pen holder or pencil for use.

Another part of the specification comprehends an improved inkstand, which may be either square or round, or of any ornamental form, provided with an inclined or spiral dip regulator, as shown in the accompanying engraving. This regulator may be made of wood or other suitable material, and is secured to a vertical spindle, A, which passes up through the cover of the inkstand, and is packed so as to be air-tight at the orifice in the cover, by a packing ring of india-rubber, or other suitable material, tightened up by the nut, B. An indicator or pointer on the top of the spindle, would show the position of the lowest part of the incline in the dip regulator, and would serve as a handle by which to turn or adjust the regulator. A lid or cover is centred on the spindle, so as to be turned over the dipping orifice in the inkstand when not in use, the underside of this cover being packed so as to keep it air-tight when pressed down by the nut, B. The engraving we have given is a section through the inkstand, showing the internal spiral false bottom turned into position, so that the pen can only dip to the desired depth into the fluid ink. A stamp damper and fixer is also specified, and is constructed on the fountain principle. It consists of a vessel enclosed in a casing for containing water, the inverted mouth of which communicates with a pad which is kept moist. The presser, when not in use, is turned sideways, so as to rest upon the edges of the trough containing the pad, and is consequently not in contact with the moistened pad, which would have the effect of attracting too much moisture. The underside of the presser may be padded or faced with gutta percha or other suitable material, and is provided with sharp points for the purpose herein before referred to. A spring is provided for holding the presser in its place when not in use, the end of such spring engaging into a nick or notch on the top of the presser. A gum holder is also included in the specification, and is constructed on the fountain principle, the gum being contained in an inverted vessel in a casing, and the brush is made sufficiently large at its lower end, to fill the mouth of the fountain, and act as a stopper thereto. A packing ring serves to keep the aperture air-tight, whilst the spring engaging into the notch at the top of the brush handle, keeps the brush in its place. A simple form of clip is described, which may be fitted to any writing pad or tablet, for the purpose of holding the paper thereon, without the necessity for touching it with the hand. Two metal fingers under which the paper is to be slipped. An under plate, which is riveted to the upper or finger plate, serves to secure the clip to the edge of the pad or tablet, and a hinged plate may be used as a clasp when the clip is applied to a writing folio.

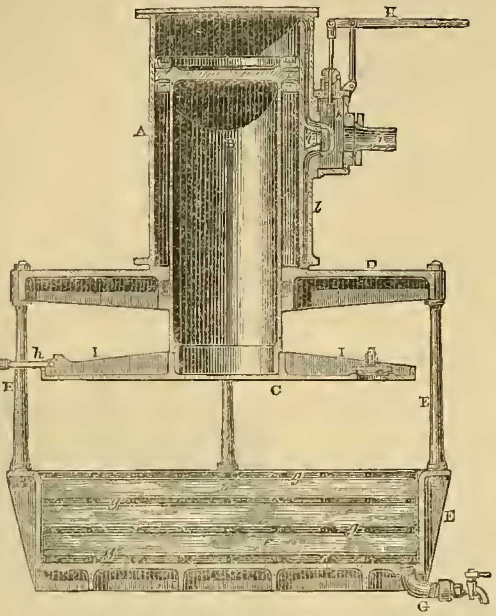


EXPRESSING LIQUIDS.

ROBERT GEOGHEGAN, *Dublin.—Patent dated September*, 25, 1860.

THE patentee's improvements relate to the arrangement and construction of machinery or apparatus for expressing liquid from semi-fluid or solid substances, such as barm or yeast, and spent grains and hops, potter's clay, and similar substances, and consists in the employment, for that purpose, of a hydrostatic press in conjunction with a containing vat or vessel for the reception of the substance to be operated upon, the table of the press working into the vessel, and expelling the liquid through suitable escape or drain pipes. The press may be worked either vertically, horizontally, or at an angle, according to the requirements of the various purposes to which it may be applied.

The subjoined engraving represents a vertical section of the apparatus. A, represents the cylinder of a hydrostatic press. B, is the ram made hollow and provided with an annular packing fitting the interior of the cylinder. C, is the pressing table secured to the bottom of the ram by a key or other suitable contrivance. The cylinder of the press is fitted on to a bed plate, D, supported by the pillars, E, which are bolted to a flange on the edge of the containing vessel, F. The fig. represents the containing vessel filled with substances to be pressed, which are shown as enclosed within canvas bags, *f*, each bag being separated from its neighbour by a wire grating, *g*. The pressing table is guided in its descent into the interior of the vessel, F, by suitable hinged and forked guides, *h*. The liquid expressed is allowed to flow off through the pipe, G, at the bottom of the vessel, F. Strengthening ribs, I, are cast on the bottom of the vessel, F, and on the top surface of the pressing table. The inlet and outlet of the water to and from the cylinder of the press is regulated by an ordinary slide valve, *k*, and ports, *l*, the valve being worked by hand, or otherwise, by the aid of a lever, H. *i*, is the water inlet pipe, and *j*, the outlet or escape port. By alternately changing the position of the slide valve, it is obvious that the water may be admitted both above the piston of the ram—so as to force it down with its full power by acting on the entire area of such piston—and below the piston so as to elevate the ram and table, in which latter case, the small annular area of the piston only is acted upon.



RAILWAY CHAIRS.

J. H. Johnson, *London and Glasgow*, (J. H. Swett, *Pittsburg, U.S.*)—*Patent dated Aug.* 30, 1860.

These improvements comprise a peculiar mode of manufacturing wrought-iron railway chairs. A bar or slab of wrought-iron is first rolled to a slightly curved or channeled form, and with two longitudinal ridges or ribs on the convex side thereof, near its opposite edge, one of such ridges being wider and higher than the other, and containing sufficient metal to form the rail-holding jaw of the chair. This bar or slab so formed is then passed vertically or edgewise between another pair of rolls, which groove or channel the larger rib, so as to form it into an overhanging lip, running from end to end of the line or slab. This bar or slab, after leaving the last-mentioned pair of rolls, is sawn transversely into short lengths, each length or section so severed corresponding to the width of the chair, the length of such chair being of course equal to the width of the bar or slab from which it has been severed. A species of mandrel of the size of the bar of the rail for which the chair is to be adapted, is now introduced under the overhanging lip of the chair; and by the aid of a blow from a fly-press or steam-hammer it straightens the chair, and finally shapes the lip, so that it will exactly fit the rail. The chairs may now have the spoke-holes formed in them, after which they are ready for use. If desired, two lips or jaws may be made by making both the ridges or ribs on the bar or slab of the same size, and large enough for the purpose. In this case, the bar should have a greater curve or channelling imparted to it, which may be subsequently taken out by hammering or rolling. The object of making the bar or slab channelled or slightly trough-shaped is to afford facility for the entrance of the grooving into the side of the ridge or ridges when forming the overhanging lip or jaw of the chair. Figs. 1 and 2 of the subjoined engravings represent a face view of the bar or slab after the two ridges or ribs, *a* and *b*, have been rolled thereon, the larger rib, *a*, is the one from which the holding jaw of the chair is formed. Fig. 2 represents the bar or slab whilst under the action of the grooving or channelling rollers, which form the lip. The roller, A, is grooved, so as to receive the larger rib, *a*, of the bar, when placed vertically or edgewise, as shown in the diagram. Above this roller, works the grooving or channelling roller or knife-edged disc, B, which enters the metal of the rib, *a*, and forms an overhanging lip from end to end of the bar or slab. This figure illustrates the object of making the bar or slab slightly trough-shaped, namely, to enable or admit of the roll or disc, B, entering the side of the rib, *a*, in a direction parallel with the opposite or under surface of the bar. The bar or slab on leaving these rolls is cut into lengths, and these lengths are each straightened by hammering, or the bar itself may be straightened or flattened before being cut into lengths, by passing it through a pair of vertical rolls, which receive it immediately on its leaving the last-mentioned or grooving rolls.

Fig. 1.

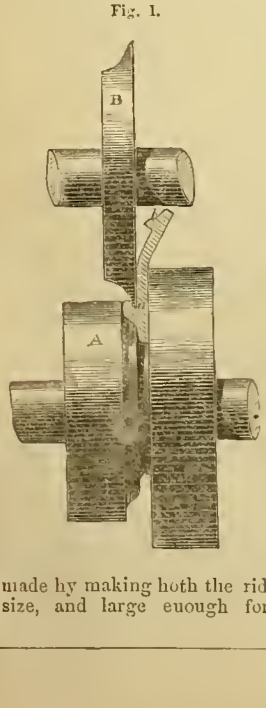
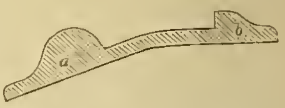


Fig. 2.



LAW REPORTS.

Frame-work Knitting: Archer *v.* James.—This case was an appeal from the decision of the Court of Queen's Bench, and was argued in the Exchequer Chamber before the Lord Chief Baron, Baron Bramwell, Justices Williams, Willes, Byles, and Keating. The case was one of great importance to the Nottingham frame-work knitters.

The action was brought against the defendants, who were manufacturers of hosiery goods at Nottingham, by the plaintiff, who had been in their employ. The declaration was for money payable by the defendants to the plaintiff for wages due, and of right payable from the defendants to the plaintiff for his work and labour as an artificer. The defendants pleaded "Never indebted" and a set-off, which latter was described in this manner:—Frame rent, at 1s 9d per week, £14 10s 5d; machine rent, at 4d per week, £2 13s 4d; standing, at 3d per week, £2; winding, at 1s per week, £8; fines, £1 5s 1d; gas, at 4d per week, £1 19s 11d; fire in waiting-room, 11s 3d.

The plaintiff's claim extended over a period of four years, and amounted to £30 10s 4d, being the exact sum covered by the defendants' set-off. The case came on for trial, when it was shown that the plaintiff worked for the defendants on their premises, using the defendants' machines. The accounts were made out weekly, and, the charges being deducted, the balance was paid to the workmen. The times during which the plaintiff worked varied, but the charges were uniform, without deductions. The plaintiff contended that this came within the Truck Acts, and therefore claimed to be entitled to the full sum he had earned. The jury found that all the deductions were according to the usage of the trade. The plaintiff was nonsuited. The case then came before the full Court of Queen's Bench, and the nonsuit was affirmed. From this decision the plaintiff appealed to this Court.

Mr Serjeant Hayes (with whom was Mr Manley Smith) appeared for the plaintiff. In one of the first Truck Acts it was stated that "whereas artificers had been compelled to take their wages in pins, girdles, and other unprofitable wares," &c. The contention of the learned counsel was that the matters stated in the set-off came within the Truck Act.—Mr Baron Bramwell said he supposed this was a kind of pilot action. The plaintiff had submitted to these terms for four years, and now came forward to try this action; and he supposed if the plaintiff succeeded every person in the defendants' employ would bring an action. He considered it was a bargain between the parties.—Mr Serjeant Hayes replied, then his Lordship would get rid of all the Truck Acts by saying there was a bargain. Why, the bargain was because he could not help himself; but such was the law of the land, and so it would remain.—Mr Justice Williams observed, that but for the Truck Acts they must have decided according to the contract, without reference to any hardship The strict point was whether this came within the Truck Acts.—Mr Serjeant Hayes continued, that the Act of the 1st and 2d William IV., cap. 37, was passed, as appeared by the preamble, "to prohibit the payment in certain trades of wages in goods, or otherwise than in the current coin of the realm." Now, the set-off which was deducted from the wages was used in payment of the wages, and they were not paid in the coin of the realm, and he therefore submitted that the case clearly came within the provisions of the Truck Act. There was a charge of rent for the knitting machine: it was absurd. A farmer might as well charge a ploughman for the use of the plough, or the driver of a railway engine be charged a rent for the engine. It was a charge upon the wages. It enabled the master to abuse his power. It was perfectly scandalous. It was a delusion to induce a man to believe he should have so much wages, when, in point of fact, the master made such charges that he could give only such wages as he chose, and that complicated the cheat. A man was charged 1s per week for "winding," and that was deducted whether he made 20 dozen or 1 dozen. It was wicked.—Mr Baron Bramwell—If the 1s was right for 1 dozen, it was a cheat on the part of the workman if he had only that sum to pay for 20 dozen.—Mr Serjeant Hayes said the workman could not help himself. These deductions were, and had been the curse of the stocking trade.—Mr Macauley (with whom was Mr Merewether) was heard on the other side. The practice was this:—A man had two or three frames, and he procured the worsted or cotton from the market town, and then he allowed persons to work at his frames, and he made a charge for them. He took the responsibility upon himself, and he lost a day or two in a week in going to and returning from the market town, and in selling the manufactured article to the wholesale man. He made the arrangement with the artificer for the charges. He was the middle man, and the defendants had destroyed this middle man, and had opened their factory to the artisan, who could at once go to the fountain head. The sum agreed to be given to the artisan for his labour included these charges. The agreement was that the defendants would find a room well warmed, machines, &c., and allow the artisan to work there, the defendants paying him a sum which, no doubt, included the rent and other charges, but that did not come within the Truck Act.—Mr Justice Willes said he could not understand why the manufacturer did not pay a particular sum, without saying anything about charges.—The Chief Baron said in that case the man would not lose by being idle, whereas now he did, because he had to pay rent for the machine.—Mr Macauley said the system had only recently been introduced into factories; the thing was in a transition state. It was difficult at first to make the adjustment. The trade, although subject to depression, yet supported an immense population, and there was a difference in the earnings and requirements between the summer and the winter. This was a mode of arriving at the net value of the work rendered. There was no payment to the artificer in anything but money. The only sum that was actually payable was paid in the current coin of the realm. The further hearing of this case was postponed.

TRADE MARKS: BASS, RATCLIFF, & GRETTON *v.* DAVID REID.—This was a Scotch case, heard before the Sheriff of Renfrewshire at Paisley. The matter came primarily before the Sheriff-Substitute, in the ordinary course, and by him judgment was given in favour of the plaintiffs. On appeal, the case came on before Mr Sheriff Campbell, whose final judgment was as follows:—

Having considered the closed record, productions, and whole process, and heard parties' procurators thereon—Finds it sufficiently instructed by the productions in process, and the admission on record, that the labels used by the defender are imitations of the labels used by the pursuers, and that the same are employed by the defender for the purpose of misleading, and are calculated to mislead the public into a belief that the ales sold by the defender in the bottles to which the defender's said labels are applied, are ales manufactured by the pursuers, whereas these ales are manufactured by other parties: Therefore, and for the reasons assigned, repels the defences, continues the interdict already granted, and declares the same perpetual, and decerns in terms of the prayer of the petition: Finds the pursuers entitled to expenses, allows an account thereof to be given in, and remits the same, when lodged, to the auditor of court to tax and report.

To this judgment the learned Sheriff added a luminous note, according to the Scottish custom, explanatory of the reasons which led him to his decision.

AGENCY: ZWHCHENBART AND ANOTHER *v.* ALEXANDER AND ANOTHER.—This was an appeal from a judgment of the Court of Queen's Bench. The plaintiffs were merchants at Liverpool, and the defendants were agents and brokers at Liverpool; and the action, which was tried at the Guildhall sittings, before Lord Chief Justice Cockburn, after Michaelmas Term, 1859, was brought to recover £695, being the difference between the price paid for 200 tons of scrap iron, less freight and duties, and that which it realised when sold by the plaintiffs. It appeared that the plaintiffs required a quantity of old scrap iron for a house at Oberhausen, and meeting with one of the defendants at Liverpool, asked him to look out for a cargo of the kind. In June, 1858, the defendants wrote to the plaintiffs to the effect that they had met with a quantity of old scrap iron, and specified the quality. Eventually the plaintiffs purchased the iron, and directed the defendants to ship it for them to Rotterdam, thence to be conveyed by rail to Oberhausen. After some correspondence as to the vessel that should be employed, the iron was put on board the Sophic, and on arriving at Rotterdam, the plaintiffs' correspondents refused to receive it, on the ground that the great bulk of it was of an inferior quality to that which they had contracted for, and the plaintiffs sustained a serious loss in consequence. The defendants' answer was that they merely acted as shipbrokers in the transaction, that they received commission from the seller of the iron, Mr Oatway, for whom they acted as broker, and also from the captain of the ship, and that they had received no commission from the plaintiffs for acting as agents in accepting the goods. The jury found for the plaintiffs, but leave was reserved to move the full Court to enter a nonsuit, on the ground that there was no evidence as to the agency of the defendants. The case was argued in the Court of Queen's Bench last Trinity Term, and their Lordships held that the defendants were not liable in respect of the loss sustained by the plaintiffs, and that, in the absence of any usage or agreement that they should inspect the iron and see to its quality, they were not bound to do so. Judgment was accordingly entered for the defendants. The cause now came before this Court on a writ of error. Mr Mellish, Q.C., appeared for the plaintiffs; and Mr Karslake, Q.C., for the defendants.—After some argument, the Chief Baron said the Court was of opinion that the judgment of the Court of Queen's Bench must be affirmed. The defendants appear to have acted as brokers to the seller and the captain, and there was no evidence to show that the defendants had undertaken to examine the iron before it was shipped.—Mr Justice Williams said he would not go to the extent of saying that, where a party acted as broker for the shipper and the ship, there was not some implied duty in respect of the shipment; but in this case he did not find that there was anything to support what was alleged as to the defendants being required to inspect the cargo.—Baron Bramwell, Justices Keating, Byles, and Willes, concurred, and the judgment of the Court of Queen's Bench was accordingly affirmed.

REVIEWS OF NEW BOOKS.

PERPETUUM MOBILE; OR, A SEARCH FOR SELF-MOTIVE POWER, DURING THE SEVENTEENTH, EIGHTEENTH, AND NINETEENTH CENTURIES. By Henry Dircks, C.E. London: E. & F. N. Spon.

THE discovery of perpetual motion, or a self-sustained, continuous motive power has, as is well known, been a favourite subject for the ingenuity of inventors; and there are probably few persons, whose attention has been turned to mechanical pursuits, who have not, at one time or other, made some efforts in this direction. These attempts, however, have been invariably unsuccessful. We say invariably, because, although two machines are usually pointed to as instances of success, we think we shall be able to show that the evidence on which the common opinion is based, is so vague and unsatisfactory that they cannot be properly regarded as exceptions to the general rule of failure. In fact, the problem has been, and still is regarded, by nearly all mathematicians of eminence as insoluble, at least, under any law of force with which we are acquainted; and so long ago as the year 1775, the Academy of Science in Paris resolved not to examine any papers relating to machines purporting to show perpetual motion. The reason which that learned body then gave for this resolution may probably be taken as accurately expressing the sense of the scientific world at the present time, viz., that "by refusing to occupy themselves with this subject, they were declaring their opinion of the complete uselessness of the labours of those who so occupied themselves." However, what Dr Johnson said of ghosts is true of the perpetual motion, "All belief is for it; all science is against it;" and, therefore, notwithstanding the authoritative condemnation of the French Academy, perpetual motion schemes were produced in as great abundance as ever; and the mania is not even yet extinct, for during the last forty years no less than seventy-two patents have been taken out in this country alone for such inventions. Several of these patents bear date in 1859 and 1860, and there seems to be no reason to believe that the zeal of the hunters after this *ignis fatuus* has in any way abated. A narrative of the numerous attempts by enthusiastic inventors thus to discover that which, so far as we know, is undiscoverable, cannot be without interest as a curious chapter in the history of the human mind; and the author of the work, the title of which heads this article, has placed such a narrative before us in a very readable form. With surprising industry, he has ransacked almost every magazine, encyclopædia, and mathematical treatise, in which notices of the subject were likely to be found; and he has also diligently searched the records of the Patent Office. The latter labour can certainly not have been lightened by the practice adopted by inventors of disguising their perpetual motion schemes under such titles as "Improvements in obtaining motive power;" "A new system of motive power, applicable for working cranes, wheels;" and the like euphemisms. The result of the author's diligence is a complete and well-arranged digest of all the literature relating to the search for a self-motive power; and it is to be hoped that his book, from the formidable array of failures which it presents, may not be without effect in deterring inventors from entering upon a path where success is impossible, and disappointment, it may truly be said, absolutely certain.

The earliest period at which we can trace the history of any practical attempt to find the self-motive power appears to be in the 16th century. We lay aside the chemical schemes mentioned by Bishop Wilkins, and referred to by Mr Dircks, such as the invention of Mr Thomas Tymme, who thus obtains perpetual motion—"By extracting a fiery spirit out of the mineral matter, joining the same with his proper air, which, included in the axle-tree (of the first moving wheel), being hollow, carrieth the other wheels, making a continual rotation, except issue and vent be given to this hollow axle-tree, whereby the imprisoned spirit may get forth." Such "chymical dreams," as the good bishop called them, never seem to have produced any practical good, and, indeed, of this particular invention he tells us, that "it seems this imprisoned spirit is now set at liberty, or else is grown weary, for the instrument, as I have heard, hath stood still these many years." But, as we have said, the first practical attempt was made in the 16th century, when, in 1594, one Edward Jentill wrote to Lord Burleigh to the effect that he had discovered "a perpetual motion of sufficient force to dryve a mill in any standing water or quicke springe, which maie alsoe be converted to sundrie other uses comodious for all estates which have hitherto byn supposed to be unpractyzable." What was the result of this invention we are not informed, nor whether it was ever brought into operation; but, from this time, similar schemes have been produced in great numbers. We do not propose to enter into a history of the various schemes which have thus been, from time to time, brought forward, or to describe the different opinions which have been broached upon the subject of perpetual motion. For this we refer the reader to Mr Dircks' interesting volume. As little do we intend to examine the possibility of any such motive power being discovered at any future time. Suffice it to say, that it may be proved, in the clearest manner, that, under the action of any forces with which philosophers are at present acquainted, perpetual motion—*i.e.*, motion which is self-sustained, not motion like that of the planets, which depends on the continuous action of *external* force—is absolutely impossible. Professor Airy has shown that a law of force may be conceived under which perpetual motion may be possible; but, with all the forces of which we have at present any knowledge, the perpetual motion is, as has been repeatedly shown, unattainable. It may, however, not be without interest to examine a little in detail the two cases in which perpetual motion is said to have been really discovered, and to see what ground there is for hoping that, if these inventions, now lost, should some day be found again, we shall be in possession of a self-motive power. These two inventions are the celebrated wheels of the Marquis of Worcester and of Orfyrreus.

Our knowledge of the former is derived from the well known Century Inventions, published by the Marquis in 1655, when it is thus described:—

"An advantageous change of centers:—To provide and make that all y^{e} weights of y^{e} descending syde of a wheele shal be perpetually further from y^{e} center then those of y^{e} mounting side, and yett equall in number and heft of y^{e} one syde as y^{e} other. A most incredible thing if not seene, but tryed before y^{e} late king of happy and glorious memory, in y^{e} Tower, by my directions, two extraordinary embassadors accompanying his Ma^{tie}, and y^{e} D. of Richmond, D. Hamilton, and most part of y^{e} Court attending him. The wheele was 14 foote over, and 40 weights of 50 pd. apiece; Sir Wm. Belford, then Lieut. of y^{e} Tower, and yet living, can justify it with several others. They all saw that noe sooner these great weights passed y^{e} diameter line of y^{e} upper syde but they hung a foote further from y^{e} center, nor no sooner passed the diameter line of y^{e} lower syde but they hung a foote nearer; bee pleased to judge y^{e} consequence."

Now this paragraph has been generally treated as an assertion by the Marquis that he had exhibited before the king a self-moving machine in actual operation. It is certainly worth observing that the Marquis says nothing of the kind. What he does say is, that he showed to the king a wheel to which certain weights were attached, and that these were so arranged that when the wheel revolved, some of the weights, as they passed the diameter (meaning apparently the vertical diameter), were further from the centre than they were before, and that others of the weights at the same time approached nearer to the centre; but he does not say that he exhibited a perpetual motion. On the contrary, he merely says, "Be pleased to judge the consequence," and abstains from stating explicitly the effect of his machine. He very probably thought, as others have done after him, that such an arrangement as he describes would produce perpetual motion, but his primary object in exhibiting his invention to the king seems to have been to show an ingenious contrivance, which he thought might be turned to some useful account. What was the object of the invention we do not know, and it is not easy to see why, if his intention had been to describe a self-moving machine, the Marquis should have only used the title, "An Advantageous Change of Centers," when, as appears from Jentill's letter to Lord Burleigh, the term "perpetual motion" was then in use, as descriptive of a desideratum in mechanics, and when such a term was not likely to be unknown to any one, who, like the Marquis, took an interest in mechanical subjects.

We are inclined, therefore, to think that the received interpretation of the Marquis's statements is incorrect, and that the paragraph above quoted is not a witness that a perpetual motion machine has ever been constructed. We follow the advice of the noble inventor, and "judge the consequences" of the arrangement he describes, and so judging, we find, on the simplest mechanical principles, that such a machine will not, whatever else it may do, produce perpetual motion.

Let us turn now to the other case which is always adduced as one in which perpetual motion, or, at least, motion for a very long period, was actually produced. This is the wheel of Orfyrreus. Orfyrreus, whose real name appears to have been Bessler, was born in 1680, in the department of Alsace, in France, and he is said to have made, at different times, four machines which would produce perpetual motion. These all seem to have been made on the same plan, and some were exhibited in public. The earliest notice of this invention is in the Leipsic Acta Eruditorum, for 1715, where it is stated that multitudes of people (hominum myriades) and persons highly skilled in mathematics and machines saw it. The notice goes on to say that the construction of the machine, which the inventor, looking for the reward of his invention, *anxiously conceals*, is understood to be most simple, consisting merely of a single wheel, &c, &c.

A further account is given by an eye-witness, Professor S' Gravesande, who, in a letter to Sir Isaac Newton, says:—"The following is a description of the external parts of the machine, the inside of which the inventor will not permit to be seen, lest any one should rob him of his secret. It is an hollow wheel or kind of drum, about 14 inches thick, and 12 feet diameter; being very light, as it consists of several cross pieces of wood framed together, the whole of which is covered over with canvas, to prevent the inside from being seen. Through the centre of this wheel or drum runs an axis of about 6 inches in diameter, terminated at both ends by iron axes of about three-quarters of an inch diameter, upon which the machine turns. I have examined these axes, and am firmly persuaded that nothing from without the wheel in the least contributes to its motion. When I turned it but gently, it always stood still as soon as I took away my hand, but when I gave it any tolerable degree of velocity, I was always obliged to stop it again by force, for, when I let it go, it acquired in two or three turns its greatest velocity, after which it revolved for 25 or 26 times in a minute. This motion it preserved some time ago for two months, in an apartment of the castle; the door and windows of which were locked and sealed, so that there was no possibility of fraud. At the expiration of that term, indeed, his Serene Highness ordered the apartment to be opened, and the machine to be stopped, lest, as it was only a model, the parts might suffer by so much agitation. The Landgrave being himself present on my examination of this machine, I took the liberty to ask him, as he had seen the inside of it, whether, after being in motion for a certain time, no alteration was made in the component parts, or whether none of those parts might be suspected of concealing some fraud, on which his Serene Highness assured me to the contrary, and that the machine was very simple."

And then he adds what will occur to most people—

"You see, sir, I have not had any absolute demonstration that the principle of motion, which is certainly within the whole, is a perpetual motion; but at the same time it cannot be denied me that I have received very good reasons to think so."

Another cotemporary notice is contained in "Zedler's Great Universal Lexicon of all Knowledge and Art," &c., published at Leipsic in 1741, where Orfyrreus is said to have exhibited his machine openly before persons of all classes:—"No outward cause of motion was observable, although examined by various artizans and others capable of judging, ; it could be moved by the finger, and had a strong inward power of its own. Being much persecuted by censures, he challenged an open trial, which occurred, October 31, 1715, before commissioners, a prince, duke, and several members of the nobility, and learned societies, all of whom signed a certificate, to the effect that they had seen it turn both right and left on the slightest impulse, soon acquiring a regular rapid movement."

It further appears that Orfyrreus refused to display the mechanism of his invention without a previous payment of 200,000 florins, and that eventually he destroyed the machine, annoyed by the examination of it made by S' Gravesande, and that he wrote on the wall a notice, to the effect, that it was the impertinent curiosity of the professor which caused him to break it.

Now what does all this amount to? Surely not to *proof* that a perpetual motion, that is a motion *renewed from itself*, without the intervention of any external cause, had been discovered. Indeed, the fact that the statements above given have been received as evidence of the discovery of a perpetual motion, is only one instance among a thousand of the utter inability of the mass of people to appreciate what *evidence* means.

Half-a-dozen people are seated round a table, which begins to move—they do not see the cause—somebody tells them it is produced by spiritual agency, and forthwith these good people go forth as converts and say, "If we had not seen it with our *own eyes*, we would not have believed it." Now, in fact, they have not seen the agency in question with their own eyes at all. They saw a table move; the rest, as has been recently well pointed out, is mere inference, and this unauthorized inference from what they saw is published abroad as having been what they actually observed. So here. A machine was exhibited, numbers of people saw it moving, some saw it moving after it was *said* to have been shut up for two months; no one knew why it moved, *ergo*, its principle of motion was within itself; and *ergo*, also, it would go on moving for ever. Now, be it observed, that no one, except the inventor and the landgrave (who does not appear to have been specially qualified to judge) ever saw the internal construction of the machine. But unless this had been examined, how are we to tell whether the machine had its motion from itself, or whether it was not moved by some external force, which would cease in time. And here it should be remembered, that any force *inside* the machine, such as a spring or similar contrivance would be in effect as much an *external* force as if it had acted on the outside. What was wanted was a machine which, by the operation of the forces which itself generated, would keep in motion for ever, and that the wheel of Orfyrreus was such an invention there is not a shadow of real proof. Why should not the wheel have been moved by some agency hidden in the machine, but really, so far as the solution of the problem is concerned, acting as an external force?

Dr Hutton tells us of a clock in Paris which had no need of being wound up, and which he says was considered a perpetual motion, though it was not so. In this clock the variations in the state of the atmosphere were employed for the purpose of winding up the weight; but this, says Dr Hutton, truly, "is no more a perpetual motion than if the flux and reflux of the sea were employed to keep the machine continually going; for this principle of motion is exterior to the machine, and forms no part of it." Moreover, Mr Dircks informs us that about the same time that Orfyrreus' wheel was exhibited, one Geiser imposed on the German public with a mere piece of clock-work as a perpetual motion. What evidence is there that this celebrated wheel was not a similar imposition? Having regard, then, to the fact, that the real construction of the machine was never properly examined by competent persons, and also to the very suspicious circumstance of its destruction by the inventor, we do not hesitate to say that we cannot regard the invention of Orfyrreus as an exception to the general rule of failure which has marked all attempts at obtaining the self-motive power.

In conclusion, we would advise all persons who have indulged in dreams of some day immortalizing themselves, by the discovery of the perpetual motion, to ponder well before they undertake a labour so certain to be fruitless. The numerous abortive schemes detailed in Mr Dircks's volume present a sad picture of time and energies—which might otherwise have been usefully employed—wasted in the pursuit of a shadow; and a perusal of the work fully warrants the opinion at which the author has arrived, and which he expresses in the following words:—"The patents here enumerated may be said to have fallen dead born, having excited no notice or attention in scientific circles. All interest in them has been confined, with one exception, to the inventors themselves, who, though they have laboured seriously and sedulously, have elicited no new fact. The display their efforts made in the following pages is anything but flattering to their knowledge, ingenuity, or practical skill. Nothing can be more disheartening than such a scene of wrecked and blighted hopes; and the sad picture should prove a salutary warning to all adventurers setting out on this shoreless ocean of enterprise."—P. 429.

CORRESPONDENCE.

THE ROTATION OF BODIES ON THEIR AXES.

Upon referring to the past correspondence on the above subject, it seems to me that Mr Mitford has already been fairly and fully answered. In the *Journal* for June, 1860, will be found a long and carefully written letter from Mr Hill, supporting the commonly received opinion of the axial rotation of the moon; the following is one of the many proofs he there brings forward:—

"Again, the experimenter, standing upright, may take the compass upon the palm of his own hand, held out at a short distance from his body, and watching the card, make one turn upon his own axis. The compass box, in such case, will move round the experimenter, keeping one side always towards him, as the moon moves round the earth. But it will inevitably present to the needle, in succession, each of its thirty-two points; and since it is not the needle that turns round, it must needs be the box."

Mr Mitford answered this very easily, by leaving it unnoticed. To the rest of Mr Hill's letter he returned a very short reply of three paragraphs, the first few lines of which may serve as a specimen of the style of the whole:—

"After three months' silence, Mr Hill, not being able to make his tape indicator produce more than one indication out of five, sends forth a new edition of his former letter of April last, with the addition of a few more *Fantoccini* lunar exercises. I may remind Mr Hill that a certain *Paganini* made numerous variations upon *one* string. Mr Hill employs *two*. Suppose another mechanic adds a *few more*, the moon might then be made to dance a hornpipe."

When, however, Mr Mitford attempts to prove the inapplicability of the tape indicator, I cannot think his reasoning altogether satisfactory. In page 280 of the last volume of your *Journal*, Mr Mitford introduced a diagram to prove that if a tape be tied to the neckcloth of a man and held by an assistant, it does not of necessity follow that he must wind the tape once round his neck every time he walks round the staff. If your readers will turn to the diagram in question, they will see that Mr Mitford first winds the tape round one half of the ball or moon, so that during one revolution round the earth, the tape is unwound from that half of the ball, and wound on to the other, which is equivalent to one revolution of the moon upon its own axis; further, Mr Mitford by his own illustration, cannot make a second revolution without producing as decided a twist as Mr Hill could desire.

Not having then read Mr Hill's letters, last February I endeavoured to prove that the moon rotated upon its own axis by the very same illustration, using a delicately balanced magnetic needle, to indicate any axial movement that might take place in a circular box placed beneath. Mr Mitford as a last resource, stated the rotation there produced to be "apparent and deceptive," on the ground that a ball cannot revolve upon a horizontal and vertical axis at one and the same time; this fact I fairly proved had nothing to do with the matter under discussion.

Mr Mitford then attempted to overcome the difficulty, not by answering my problem, but by substituting another, in which he placed a strong magnet (or the north pole), in the place of the earth in my imaginary circle, to attract one end of the needle, and render it incapable of registering the motion of the box beneath, since they would then both revolve together. He also wanders from the subject to criticise an expression made use of by me, respecting a "motionless magnetic needle," and innocently asks, "Who ever heard of a compass with a motionless magnetic needle? What seaman would go to sea with such an instrument? Why take the trouble to balance a needle so nicely upon a pivot, if one without motion would equally answer the purpose?" Simply, it is balanced so nicely upon a pivot that it may remain as motionless as possible upon its vertical axis. As a general rule it is the ship and the pivot that rotate—not the needle.

Lastly, Mr Mitford seeks to evade giving any proof of his assertion that the motion is "apparent and deceptive," thus:—"From the commencement of this discussion I have represented the moon and earth as balls, or spheres,—the only legitimate representation of these bodies—and therefore recognize no other. Hats, crank-pins, and compass needles, are as unnecessary to the matter in hand as gridirons, tea caddies or opera glasses." What does it matter, whether we use a sphere, a circular disc, a tea caddy, or a warming pan, so that we prove it rotates upon its axis? If Mr Mitford will reconsider the matter, I am sure he will candidly own that the illustration I gave was strictly in point, and that unless he can satisfactorily explain that it is not so, his theory must fall to the ground.

Here is another extract—"Mr Harrison, like a true pupil of the Hill and Herschel school, arranges his apparatus to suit his own wishes." Of course I do, and Mr Mitford does not appear to approve at all of the manner in which that apparatus has been arranged. Sir John Herschel's school of astronomy may be a very foolish one, still his opinion that the moon rotates upon its own axis, carries considerable weight with the majority of the public, even though his arguments were unsupported by elegant allusions to moons dancing the hornpipe, owls twisting their heads off, tea caddies, and gridirons.

In the example given in my letter of February last, every portion of the rim of a circular box, passed in succession beneath the points of a magnetic needle, which remained motionless upon its vertical axis. Mr Mitford has yet to prove that motion a deception.

William H. Harrison.

Haverfordwest, South Wales, May, 1861.

On reading the report of Mr Correy's and Sir J. Paxton's speeches in the House of Commons, in the *Times*, on the objection to the use of iron war ships—that the bottoms become foul, and impede their speed—I beg to inform you that I believe my diving apparatus, No. 96 in the catalogue of the Society of Arts, is adapted for use in clearing ships' bottoms. The apparatus for the use of a diver can be made and sold for about £20, and is attended with no expense in using. I believe the diver can work with his hands under water, especially at slight depths, such as the depth of a vessel in the water, with about the same ease that he could work in the water. I and others have repeatedly tried it.

John White.

Finchley, May, 1861.

THE MAGNETICAL DEVIATIONS OF THE COMPASS.

II.

According to promise, I now proceed with an examination of this important question, Compass Deviations, as I have much to advance on this vexious question, not from theory, but from observation and practical experience, believing that one page of practical experiments is at all times worth a thousand of theory. Theory *is* useful because it is suggestive, but practical observation and experiments must at all times decide. We know that it was the prevailing theories of the time which consigned Galileo to the dungeon for giving expression to the dawning ideas of a moving solar system, which remained to be finished by the great master-mind of a Newton.

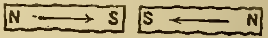
The close of the last century and the beginning of the present, present to us many brilliant theories, the rays of which are now coming forth in a consolidated form from a Faraday, a Sabine, and a Thomson.

In following out this important question, I will endeavour to be guided by the luminous combined observations of the one, and the practical experimental deductions of the others. I know well what it is to differ from acknowledged views or theories; but, as time passes on, necessity compels a hearing; for we know well that the indications of the compasses in iron ships is far from being satisfactory. This requires no evidence, so that the pressure of the question compels a free and candid examination; for it is now too late to be politely informed that such and such views are not approved of, finished with a learned twitching of the head. *Miserable philosophy.*

The discovery of the magnetical influence is so far back that it would only be an unnecessary waste of time to offer any history of it, as it will be sufficient to deal with that part of it which we do know. Magnetism is a science that may be still viewed as in its infancy. A few facts have been determined; and it is only within these few years that the science has assumed a few clear and distinctive fundamental principles, which observations, experiments, and time have confirmed. The term magnetism is understood to express that property which certain bodies, when charged with it, indicate—energy or motion. This condition of matter is indicated more particularly in all bodies that have iron as their basis. It is also indicated very distinctively in a mineral substance called the native magnet, or loadstone. The distinctive properties of magnetism are usually expressed thus—attraction, repulsion, inducing, and receiving. These have usually been considered as constituting four distinct elements or powers. There are many good reasons to doubt the correctness of these definitions, and I think they prevent us from reasoning the science upon mechanical principles. It may be said, why reason it upon mechanical principles? Because its indications are clearly mechanical—that of inducing and receiving. Besides, it is necessary that we reason on some known laws that we have a clear perception of—and there is no science so perfect and so well understood as that of the mechanical laws—for it is only by analogy, in likening the indications of magnetism to something that we do know, that we can at all find language to express our views or ideas on the question.

The first definitions of magnetism are attraction and repulsion. These clearly imply two distinct and opposite forces. For the evidence of this we are referred to the magnetic bar, the one end attracting and the other repelling. We may naturally inquire, does the one-half of the bar attract the force and the other repel it? We know of no law which can assist us, by any process of reasoning, to offer an explanation. We know by the mechanical law of forces, that forces which are equal can only remain in equilibrium, and, for the time, cease to indicate energy or force; but we know that this energy still continues. Then does one-half of the bar receive one description of force and the other an opposite? This seems equally absurd. Then, do the forces reside in the bar? We think not; for we know that we can induce it in bars that seemed to be free of it, so far as indicative of energy or power; for we know, when we induce magnetism by physical action, or otherwise, that the structure of the mass composing the bar undergoes a change, thus clearly indicating that a certain arrangement within the mass is necessary previous to its indication of energy. We may now freely inquire, did the mass, in its former arrangement, resist energy, or was the energy in equilibrium with the inertness of matter, waiting for the touch of energy to overcome the equilibrium of the mass and reconstruct it so as to indicate energy? Then is energy not a property of matter? We think not. Matter seems passive, and is acted upon by impulse or energy, which is co-existent with matter, but independent of it.

Let us now endeavour to explain why attraction and repulsion are indicated in the magnetic bar. I have often endeavoured to reason the magnetical indications on hydrostatical principles—that of the flow of fluids forming currents. Then let us, by analogy, suppose a current setting in any particular direction, similar to the annexed engraving. Suppose the force of the current setting from north to south. Now let us suppose the force of another current, of less force, setting in the opposite direction, that is, from south to north. It will be evident that, if the opposite currents were equal, they would repel each other, and thus induce motion at right angles to that of the others; but the one being weaker than the other, becomes absorbed in the stronger, so that this, so far, represents to us the effects indicated by two magnets.



Paul Cameron.

ROTATORY MOTION OF THE MOON.

Having received, a few days ago, from Mr Jonathan Davidson, Edinburgh, copies of communications on the above subject sent to your Journal, and which appeared in recent numbers, I beg to offer you with a few observations which I hope you will find space for in your first impression.

Mr Davidson wrote a letter to the *Witness* newspaper, which appeared on the 7th July, 1860, and I sent a letter in reply, which I quote, as he makes some strictures upon it without stating my arguments.

"In reference to recent communications in the *Witness* on the above subject, I think it is a mistake to suppose that the moon does not turn on an axis *within itself* in its revolution round the earth; and beg to refer to a motion of the same nature easily seen, exemplified in that of the shaft and crank-pin of the steam engine. Let any person watch the pin while performing a revolution round the shaft, and he will perceive that the pin does turn; for he will observe that the uppermost side of the pin when the crank is on the one dead point, is lowest when on the other. The pin may be distinctly seen to turn on its own axis in the brasses of the connecting rod, which in consequence of that turning, are among the first bushes that get worn in a steam engine. It is quite true, that the moon always presents the same face to the earth; so does the pin to the centre of the shaft round which it turns, and for that reason must turn on its own axis while performing the revolution, otherwise it would resemble the beautiful motion invented by James Watt, and sometimes in use instead of the crank, viz. the sun and planet motion, where a driving wheel is fixed on the end of the connecting rod, and geared into another wheel fixed on the shaft. In working, that on the connecting rod travels round the wheel on the shaft, thus presenting all sides to it without turning itself, and this would be the case with the moon, if it did not turn on its own axis."

Mr Davidson remarks on the above, that my argument from the motion of the crank-pin is more plausible than real; that if it turns on its axis, then every particle of the pin, however small, must turn on its own axis also; that if it were reduced to a bundle of wires, each wire would turn on its own axis, also, every particle of the crank, &c., &c. I answer, yes. Each particle of the pin, crank, &c., would so turn as surely as the pin does.

He further says, if I look at the pin from the shaft, that I will see that the pin does not turn on an axis within itself; if I will extend the shaft to the same length as the pin, grasp the pin with the hand, and set it in motion, the shaft will soon make me feel that it is the axis of the pin's motion; and thus my sense of feeling will correct my sense of vision. I admit that, viewed from the shaft, the pin does not appear to turn as above, neither would the shaft appear to move round, if looked at from the pin, although its turning is an undoubted fact; and I assert that the shaft is not the proper position to look from, to ascertain whether the pin turns on its axis, no more than being inside of a coach or steamboat, would be the proper place to know whether or not they were turned round, for in either of these cases the persons, seats, &c., would maintain the same relative position; hence, those within might not be aware that they turned at all, while to one looking from the outside nothing could be more clearer than that the whole turned. In like manner, with regard to the crank and pin, they maintain their relative positions when viewed from the shaft; and, for this reason the pin must turn on its own axis, as certainly as the shaft and crank to which the pin is fastened does turn. How otherwise could it present its whole circumference at each revolution, as surely as the shaft does at each turn, as any person looking at it from without will easily perceive; and so with the moon to a spectator looking at it from a position external to its orbit, he would see at each revolution its whole circumference, while to the earth it always presented the same side.

I would ask Mr D. if the pin does not turn on its own axis, why should it always be round? If of any other shape would it work in the connecting rod? I would advise him to try to turn a grinding-stone with the handle square, triangular, or flat; and, if I mistake not, "his sense of feeling would correct his sense of vision," and convince him that it after all must turn; or let him fasten a chain, or end of a stout rope, to the end of a crank pin, and standing in front of it, grasp it firmly, and try how long after it was set in motion he could keep it from turning on its own axis. And if it must thus turn, how could the pin communicate this motion, if it had not had that motion itself?

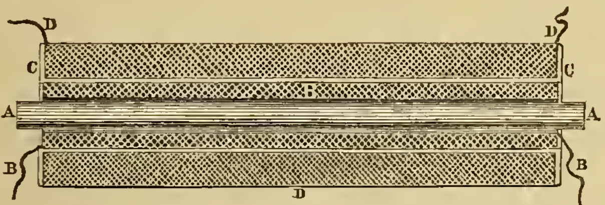
John Whyte.

Easdale, May, 1861.

INDUCTION COILS.

Having lately had the pleasure of hearing a lecture delivered by Dr Dalzell, of Edinburgh, on the Induction Coil, wherein he particularly alluded to the great accuracy required in their construction—from my own experience in manufacturing various forms, sizes, and methods of insulation for the last twenty years, I now beg to offer what I consider to be the most simple Coil yet constructed, wherein no great degree of care is required.

The method I adopt will be readily understood from the accompanying engraving.



The core, A, is composed of about No. 14, carefully annealed iron wire enclosed within three or four rounds of cartridge paper thoroughly saturated with shell-lac. The primary coil, B, B, is composed of say nine No. 26 wires in one covered with cotton and wound around the core, A, beginning at the one end, and progressing regularly towards the other end, the terminals being connected with the battery condenser and contact brake respectively. The secondary wire, D, say No. 26 to 36, I have found to answer extremely well, requiring nothing further than the cotton covering; this wire is coiled around and upon the glass bobbin, C, beginning first, by filling in the corner, and then by traversing the whole length up and down, somewhat similar to winding a common bobbin of thread. The terminals are by this means removed to their greatest possible distance from each other, and with merely the simple cotton covered wire, I have never found the slightest tendency to strike from one coil to the other, which is often the result produced by the ordinary method of forming the coil.

A. Farquhar.

Glasgow, May, 1861.

The following problem, when practically resolved, would show how to use a given quantity of material without waste, for a certain purpose, with the least amount of work:—

Problem—With 21 quadrilateral pieces of wood four different groups of squares may be formed. The total number of squares successively obtained is 10, among which 7 are different from each other.

Fr. Elefanti.

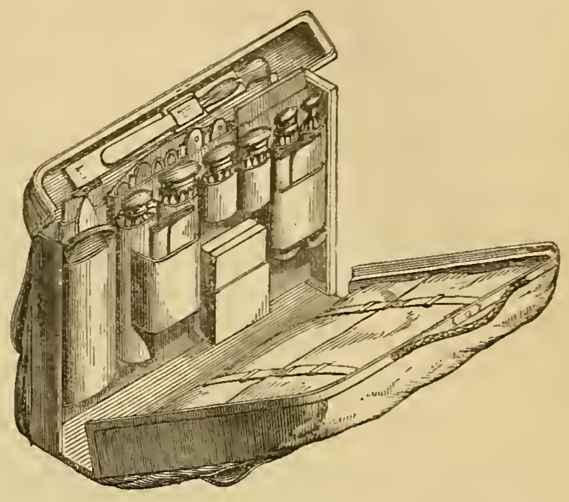
Glasgow, May, 1861.

REGISTERED DESIGN.

THE MECHIAN TRAVELLING-BAG.

Registered for Messrs Mechie & Bazin, *of Regent Street.*

The purpose of utility to which the shape and configuration of this design has reference, is the obtainment of easy access to all the various articles contained within a travelling-bag. The accompanying engraving is a perspective view of the improved travelling-bag. One side or half of the bag is rigidly secured to the bottom, and remains vertical, whilst the corresponding side or half is made to fold back into a horizontal position when opened. One side contains all the usual fittings of a dressing-case, or work-box, and is provided with an outside pocket. The upper part of this side is hinged to the lower position, so as to be capable of turning back, and exposing more effectually the fittings arranged beneath it. The other side is hinged to the bottom, and contains articles of wearing apparel, disposed beneath the leather flaps, the whole being held together by the elastic straps or bands. There is an outside pocket on the hinged side, corresponding to the pocket on the opposite side.



PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PARIS ACADEMY OF SCIENCES.

Researches on the composition of cast-iron and of steel. By M. E. Fremy.

In a former communication, I had the honour to inform the Academy that iron, steel, and cast-iron were not, in my opinion, connected with one another by the conditions of composition usually supposed to prevail, and that it was not correct to say that steel was simply a combination of iron and of carbon, in which there was a smaller proportion of carbon than existed in cast-iron. Without wishing to deny absolutely the influence which the quantity of carbon exercised upon the qualities of the cast-iron and of the steel, I propose now to show that certain other metalloids may modify those qualities; that those metalloids do not occur in an accidental manner in the compounds referred to; and that all the uncertainty which now attends the manufacture of steel may, perhaps, be explained by the action of these extraneous substances, which action has hitherto been little studied.

The experiments I propose to submit to the Academy on this occasion are designed for the purpose of determining the conditions under which nitrogen may combine with iron.

Every chemist is aware that the important discovery of the azotising of iron is due to our learned associate, M. Despretz. He it was who first proved that at a red heat, iron decomposed ammoniacal gas, fixed its nitrogen, and became white, and brittle, assuming, under these circumstances, an increase of weight, which occasionally attained 11·5 per cent. of the weight of the metal. The body so obtained, when submitted to the action of acids, contained a salt of iron and an ammoniacal compound.

These very clear results have, however, been called in question by some chemists. Some have thought that the increase of weight is to be explained by an oxidation by the water, or by the air contained in the ammoniacal gas; others have admitted that the modifications in the physical properties of the iron were due to the alternation phenomenon of the oxidation of the metal, and of the reduction of the oxide by the hydrogen of the ammonia. Whilst I was myself perfectly convinced of the correctness of the experiments of our learned associate, I nevertheless thought it advisable to repeat those of them which had been questioned, taking care to eliminate every source of error, arising from either the impurity of the ammonia or from the presence of moisture in the gas. I am anxious at once to say that my experiments, in every respect, confirm the results of M. Despretz's observations. On all occasions I have found that iron, at a red heat, has decomposed ammoniacal gas, and has produced the white brilliant substance described by M. Despretz as the nitride of iron.

It has been suggested that the product of the decomposition of the ammonia by the iron might be a combination of the metal with the hydride of nitrogen, containing less hydrogen than the ammonia. I thought that this question might be decided by experiment; for, in fact, under the influence of oxygen, the compound studied by M. Despretz produces a peroxide of iron. By effecting this decomposition in a porcelain tube, communicating with other tubes intended to fix the water which the reaction might produce, it was easy to discover whether the compound were a nitride or merely an oxide of iron. This experiment was conducted with the greatest care. A known weight of the azotised compound was raised to a red heat in a current of oxygen; the metal was transformed into a pure peroxide of iron, nitrogen was given off, and the tubes used for the purpose of fixing the water were not increased in weight. The experiment, then, seemed to me to be conclusive, and to prove that the body produced by the action of the nitrogen gas upon the iron is really a nitride of iron, and that it does not contain hydrogen.

Having ascertained this essential point, it was necessary to determine the other circumstances under which iron could combine with nitrogen; and for this purpose I began by examining the action of nitrogen on metallic iron.

The nitrogen was produced either by the decomposition of the nitrate of ammonia or by the action of copper upon atmospheric air; the gas was purified and dried by the most efficacious processes. It appeared, from these essays, that nitrogen did not easily combine with iron prepared in the ordinary way, but that it did easily combine with that metal when the latter was in process of formation. Thus I succeeded in obtaining the nitride of iron, by directing the nitrogen on the oxide of iron at the moment of its reduction, either by hydrogen or by charcoal. I found that cyanogen likewise affected the qualities of iron; but I reserve the consideration of this reaction to my next communication, which will be devoted to the consideration of the combined action of the nitrogen and carbon on iron.

By the processes above described, the nitride of iron is doubtlessly obtained, but the reactions are slow and incomplete. Thus, in order to bring small fragments of iron wire to the state of nitrides, I was obliged to pass the current of gas, during three entire days, over the iron at a red heat. I was therefore forced to seek another method of obtaining this metallic nitride, in order to be able to submit the nitride of iron to a careful chemical examination, and to study the influence which this body is able to exercise on the constitution and properties of steel; and this object I was fortunate enough to be able to attain by decomposing, at a red heat, the protochloride of iron, by means of dry ammoniacal gas. For this purpose I introduce into a porcelain tube about 200 grammes of the protochloride of iron; I raise the tube to a bright red heat, and I cause to pass over this salt a current of ammoniacal gas, obtained from the ammoniacal liquor of commerce. The gas is dried by passing through long tubes filled with caustic potash. Under the influence of the ammoniacal gas the metallic chloride is rapidly decomposed, the hydrochlorate of ammonia given off, and a rusty salt, of a very curious nature, is given off, which salt water decomposes immediately, producing ammonia and oxide of iron. After the operation, a spongy, partially fused, mass is formed in the tube. It is sometimes of a grey colour, and often also metallic, white, and brilliant. This body is the nitride of iron sought for.

I have the honour to submit, for the inspection of the Academy, about 200 grammes of the nitride of iron obtained by the process above described. This substance, previously almost unknown to chemists, may thus be obtained hereafter with the greatest ease; and I have no doubt but that it will become a new precious agent, by means of which we may be enabled to communicate nitrogen to mineral substances, or to organic bodies, in our future researches. The process thus employed, for the production of the nitride of iron, is applicable for the production of other metallic nitrides; for I have obtained by the same process other combinations of nitrogen with the metals of the same group as iron, which will be described in a special mémoire.

I have ascertained that the nitride of iron, obtained by the decomposition of the protochloride of iron by ammoniacal gas, possesses all the properties of the nitride of iron obtained by passing ammoniacal gas over iron at a red heat. This nitride of iron is easily reduced to powder. It is slowly attacked by nitric acid; but it is easily attacked by sulphuric and hydrochloric acids. In dissolving in these acids, the nitride of iron produces both salts of iron and salts of ammonia. From some experiments, made at my request, by M. E. Becquerel, it appears that the nitride of iron easily becomes magnetic in a permanent manner like steel; but it would appear that this property is developed in a rather less degree in the nitride than it is in ordinary steel. The nitride of iron is remarkable on account of its stability, and in this respect it resembles the nitride of titanium, studied with so much care by Messrs Wolher & H. Deville; in fact, it supports a red heat without decomposing. Oxygen only attacks it at a high temperature, and transforms it into a peroxide of iron.

ROYAL INSTITUTION OF GREAT BRITAIN.

April 12, 1861.

"On the Application of the Law of the Conservation of Force to Organic Nature." Professor Helmholtz, F.R.S. The most important progress in natural philosophy by which the present century is distinguished, has been the discovery of a general law which embraces and rules all the various branches of physics and chemistry. This law is of as much importance for the highest speculations on the nature of forces, as for immediate and practical questions in the construction of machines. This law at present is commonly known by the name of "the principle of conservation of force." It might be better perhaps to call it, with Mr Rankine, "the conservation of energy," because it does not relate to that which we call commonly *intensity* of force; it does not mean that the intensity of the natural forces is constant: but it relates more to the whole amount of power which can be gained by any natural process, and by which a certain amount of work can be done. For example: if we apply this law to gravity, it does not mean, what is strictly and undoubtedly true, that the intensity of the gravity of any given body is the same as often as the body is brought back to the same distance from the centre of the earth. Or with regard to the other elementary forces of nature—for example, chemical force: when two chemical elements come together, so that they influence each other, either from a distance or by immediate contact, they will always exert the same force upon each other—the same force both in intensity and in its direction and in its quantity. This other law indeed is true; but it is not the same as the principle of conservation of force. We may express the meaning of the law of conservation of force by saying, that every force of nature when it effects any alteration, loses and exhausts its faculty to effect the same alteration a second time. But while, by every alteration in nature, that force which has been the cause of this alteration is exhausted, there is always another force which gains as much power of producing new alterations in nature as the first has lost. Although, therefore, it is the nature of all inorganic forces to become exhausted by their own working, the power of the whole system in which these alterations take place is neither exhausted nor increased in quantity, but only changed in form.

It may be considered as proved at present, that if heat produces mechanical power, that is mechanical work, a certain amount of heat is always lost. On the other hand, heat can be also produced by mechanical power, namely, by friction and the concussion of unelastic bodies. You can bring a piece of iron into a high temperature, so that it becomes glowing and luminous, by only beating it continuously with a hammer. Now, if mechanical power is produced by heat, we always find that a certain amount of heat is lost; and this is proportional to the quantity of mechanical work produced by that heat. We measure mechanical work by foot-pounds, and the amount of heat we measure by the quantity of heat which is necessary to raise the temperature of one pound of water by one degree, taking the centigrade scale. The equivalent of heat has been determined by Mr Joule, of Manchester. He found that one unit of heat, or that quantity of heat which is necessary for raising the temperature of a pound of water one degree centigrade, is equivalent to the mechanical work by which the same mass of water is raised to 423½ metres, or 1389 English feet. This is the mechanical equivalent of heat.

Hence, if we produce so much heat as is necessary for raising the temperature of one pound of water by one degree, then we must apply an amount of mechanical work equal to raising one pound of water 1389 English feet, and lose it for gaining again that heat.

By these considerations, it is proved, that heat cannot be a ponderable matter, but that it must be a motive power, because it is converted into motion or into mechanical power, and can be either produced by motion or mechanical power. Now, in the steam-engine we find that heat is the origin of the motive power, but the heat is produced by burning fuel, and therefore the origin of the motive power is to be found in the fuel, that is, in the chemical forces of the fuel, and in the oxygen with which the fuel combines.

You see from this, that the chemical forces can produce mechanical work, and can be measured by the same units and by the same measures as any other mechanical force. We may consider the chemical forces as attractions, in this instance, as attraction of the carbon of the fuel for the oxygen of the air; and if this attraction unite the two bodies, it produces mechanical work just in the same way as the earth produces work, if it attract a heavy body. Now the conservation of force, of chemical force, is of great importance for our subject to-day, and it may be expressed in this way. If you have any quantity of chemical materials, and if you cause them to pass from one state into a second state, in any way, so that the amount of the materials at the beginning, and the amount of the materials at the end of this process be the same, then you will have always the same amount of work, of mechanical work or its equivalent, done during this process. Neither more nor less work can be done by the process. Commonly, no mechanical work in the common sense is done by chemical force, but usually it produces only heat; hence the amount of heat produced by any chemical process must be independent of the way in which that chemical process goes on. The way may be determined by the will of the experimenter as he likes.

We must consider the living bodies under the same point of view, and see how it stands with them. Now if you compare the living body with a steam-engine, then you have the completest analogy. The living animals take in food that consists of inflammable substances, fat and the so-called hydrocarbons, as starch, and sugar, and nitrogenious substances, as albumen, flesh, cheese, and so on. Living animals take in these inflammable substances and oxygen; the oxygen of the air, by respiration. Therefore, if you take, in the place of fat, starch, and sugar, coals or wood, and the oxygen of the air, you have the substances in the steam-engine. The living bodies give out carbonic acid and water; and then if we neglect very small quantities of more complicated matters which are too small to be reckoned here, they give up their nitrogen in the form of urea. Now let us suppose that we take an animal on one day, and on any day afterwards; and let us suppose that this animal is of the same weight the first day and the second day, and that its body is composed quite in the same way on both days. During the time—the interval of time—between these two days the animal has taken in food and oxygen, and has given out carbonic acid, water, and urea. Therefore, a certain quantity of inflammable substance, of nutriment, has combined with oxygen, and has produced nearly the same substances, the same combinations, which would be produced by burning the food in an open fire, at least, fat, sugar, starch, and so on; and those substances which contained no nitrogen would give us quite in the same way carbonic acid and water, if they are burnt in the open fire, as if they are burnt in the living body; only the oxidation in the living body goes on more slowly. The albuminous substances would give us the same substances, and also nitrogen, as if they were burnt in the fire. You may suppose, for making both cases equal, that the amount of urea which is produced in the body of the animal, may be changed without any very great development of heat, into carbonate of ammonia, and carbonate of ammonia may be burnt, and gives nitrogen, water, and carbonic acid. The amount of heat which would be produced by burning urea into carbonic acid and nitrogen, would be of no great value when compared with the great quantity of heat which is produced by burning the fat, the sugar, and the starch. Therefore we can change a certain amount of food into carbonic acid, water, and nitrogen, either by burning the whole in the open fire, or by giving it to living animals as food, and burning afterwards only the urea. In both cases we come to the same result.

April 19, 1861.

John Ruskin, Esq., on Tree Twigs.

ROYAL SOCIETY.

April 18.

"On the effect produced on the Deviations of the Compass by the length and arrangement of the Compass Needles, and on a new mode of correcting the Quadrantal Deviation," by A. Smith, Esq., and J. Evans, Esq.—In correcting, by magnets, in the usual way, the semicircular deviation of an ordinary single-needle compass, if the magnets be placed too near the compass, a sextantal error is introduced; and so, in correcting the quadrantal error in the usual way, by masses of soft iron, an octantal error is introduced. The aggregate of the sextantal and octantal errors may become serious. This error was first observed and traced to its cause by Mr Evans in the standard-compass of the Great Eastern, which had been corrected by Mr Gray, of Liverpool, and in which it amounted to between 5° and 6°; but Mr Evans made the very remarkable discovery that these errors are not introduced, if, instead of a single-needle compass, a compass constructed on the plan of the Admiralty standard compass be employed. In that compass the needles are four in number, and are placed parallel to each other in pairs, at angles of 15° and 45° from the ends of a diameter which is parallel to them; and the singular mathematical result was obtained which agrees with Mr Evans's experiments, that this arrangement of needles which was long ago devised for a totally different purpose, has, by a happy coincidence, the property of destroying the sextantal and octantal errors. The authors, therefore, strongly recommend that all corrected compasses should be constructed either as the Admiralty standard compass, or with two parallel needles each 30° from the end of the diameter which is parallel to them. The second part of the paper contained a description of a plan, proposed by Mr Evans, for correcting the quadrantal deviation by the reciprocal action of two compasses, arranged as in the ordinary double binnacle. It was long ago observed that two such compasses produce on each other a *negative* quadrantal deviation; and Mr Evans having found the quadrantal deviation in all iron ships to be *positive*, it occurred to him that it might be corrected by this arrangement. It is remarkable that this arrangement—against which Capt. Johnson, the late superintendent of the compass department, gave emphatic warnings as producing a dangerous disturbance of both compasses—turns out, from the knowledge we now have of the uniformity in amount and direction of the quadrantal deviation in iron ships, to be the most effectual and convenient mode of correcting it. Its use, however, requires some precautions. The compasses must be of equal power, and there should be a means of adjusting their distance from each other in ships going to extreme magnetic latitudes; and, in order to avoid an octantal error, the compasses should have compound needles.

SCOTTISH SHIPBUILDING ASSOCIATION.

May 6, 1861.

This was the last meeting of the session—The paper was on "The deviation of the compass in iron ships, with special reference to the magnetic direction of the line of building," by Mr M. M'N. Walker.

Mr Walker began by noting the progress of magnetic science, from the earliest Chinese knowledge of the compass to the present time—and taking the position of the science about the time iron began to be used extensively in ships, first as machinery, and latterly as the ship itself, he commented upon what had been done by Professor Airy, Scoresby, and others, to extend our knowledge of the magnetic properties of iron ships. It was early discovered that every iron ship possesses a magnetic individuality, but it was not generally known, nor even well understood by those who were most conversant with the subject, that besides their generic individuality, every iron ship possesses a local character common to all vessels built in the same locality, and a family character common to all vessels built in the same place, or with their heads in the same magnetic line. In every iron ship there is a neutral line of no deviation in plane, at right angles to the line of the dip of the needle, and the compass should be placed as nearly as possible in the position determined by the magnetic and neutral lines due to the position and direction in which the ship is built. He had invariably found that ships built with their heads due south, or thereby, had the smallest compass deviation, and were least liable to change, seldom exhibiting, after long periods of service, more than three or four degrees of variation. In such ships the neutral line cuts the deck a few feet from the stern, at the position usually occupied by the after-compass. In those vessels a masthead compass was of very little use, as it required to be elevated upwards of 60 feet before it would be beyond the magnetic influence of the hull. In ships built with their heads to the north, the polarity of the iron of the ship was entirely reversed, and the neutral plane cut the deck well forward. In this case the standard compass should be about the foremast; and a stern compass, elevated fifteen to thirty feet above the deck was usually quiet correct, while a compass on the deck would have its poles reversed. All the other points of the compass have their specific individuality, and it seems to be matter for congratulation that the law of compass deviation in iron ships, like the law of storms and every other law of nature, only awaits patient and painstaking investigation at the hands of competent men to become an open book to the seaman—at present too often bewildered by its apparent eccentricities. Mr Walker concluded by calling the attention of the Association to the insufficient state of the adjusting moorings at Gareloch, and trusted they would move the Clyde Trustees to take the matter into consideration.

ASSOCIATION OF ASSISTANT ENGINEERS.

May 7, 1861.

This was the fourth and last ordinary meeting of the session—The papers read, were:—On "Military Engineering," describing the various operations of the military engineer, both in aggressive and defensive warfare, by Mr W. Y. Black. On "Machine Riveting," with special reference to the different machines now in use, by Mr John Harvey. Mr Harvey was followed by Mr John Aitken, who read a paper on "Electro-Dynamics." The first two of these papers were well illustrated by diagrams, and the last by means of an electric engine, which was put in motion.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

April 30, 1861.

The annual report of the council was read:—

Since the last annual meeting the number of members has somewhat increased. The society contained at that time two hundred ordinary members. Of these, five have died and four have resigned, whilst twenty-three new members have been elected; so that the number at present amounts to two hundred and fourteen.

MONTHLY NOTES.

MARINE MEMORANDA.

Preparations have been commenced at Chatham dockyard for building the temporary dam which is to be placed at the entrance of No. 2 dock, in lieu of the present caisson, in order that additional space may be obtained for the building of the large mail-clad steamer *Achilles*, 40. The length of the second dock, in which it is intended to build the new iron war steamer, is 336 feet, but by the substitution of a dam for the caisson now at the entrance an addition of about 20 feet will be gained. The steam travelling cranes which are in course of erection along each side of the dock by Messrs Taylor and Co., of the Britannia Works, Birkenhead, will be completed in the course of a few weeks. These machines are of the most powerful description, and capable of lifting the heaviest portion of the iron work which will be used in the construction of the new frigate.

The *Duncan*, 151, screw, in the second class steam reserve at Portsmouth, has commenced on a series of trials to test her three-bladed iron propeller. In her trial of August last she attained a speed of 13·335 knots, accompanied by a great and very peculiar vibration below. The propeller used on that occasion was one of Griffith's patent, of 20 feet diameter, and a pitch of 26 feet. The diameter of the iron propeller with which the present series of trials were commenced is 19 feet 3 inches, with a pitch of 27 feet 10 inches. Six runs were made on this as on the former trial, and the results, by comparison between the two trials, were a reduction in speed of 100th of a knot, with six revolutions less, and the vibration considerably less than before. The blades of the iron propeller are of the common form, with their leading edge uncut, but will undergo certain alterations during the forthcoming trials. The great fault of the three-bladed propeller lies in the necessity its use imposes of docking the ship when required to be got at her for any purpose, instead of lifting it through the screw aperture. as is done with the two-bladed propeller.

The *Newcastle*, 51, screw steam frigate, which was recently launched at Woolwich, made her official trial trip at Sheerness on the 8th ult. The frigate left the steam basin at 9 30 a.m., in charge of Captain Schomberg, commanding the steam reserve at the port, and steamed out of the harbour for the trial ground, off Mappling Sands. Mr Price, inspector of machinery afloat at Sheerness, and Mr Townsend, foreman of the engineering department at Sheerness Dockyard, were on board and superintended the trial on the part of the Government. The contractors, Messrs Ravenhill, Salkeld and Co., were represented by Messrs Ravenhill and Hodgson. The *Newcastle* is of 600 nominal horse-power. Her engines worked beautifully, and showed very little variation in their revolutions. Her steering qualities were very good. She made six runs at the measured mile, the vessel drawing 19ft. 10in. of water aft, and 15ft. 7in. forward, (Griffith's screw, pitch 27, diameter 28). The average of the six runs gave a speed of 13·286 knots per hour. Revolution of engines, 60; pressure of steam, 20; vacuum, 25. There was a total absence of hot bearings, and the machinery worked very satisfactorily. The trial lasted seven hours.

A new iron paddle-wheel steamer, named the *Lord of the Isles*, and intended for the station between Southampton and the Isle of Wight, and Portsmouth, had a trial at the measured mile on the 6th ult., and lately she has had a preliminary run of some hours with a party of the directors and their friends on board. The *Lord of the Isles* was built by the Thames Iron Ship-building Company at Blackwall, from a design of Mr James Ash, and her engines, which are of 60 nominal horse-power, were constructed by Mr John Stewart, of Blackwall. Her length between perpendiculars is 130 feet; extreme breadth, 18 feet; depth, 7 feet 6 inches; burden, 205 tons builders' measurement; and she only draws four feet of water. At the trial on the 6th ult. she ran the measured mile in Stokes Bay four times, attaining the main speed on the first two runs of 14·17 knots per hour, and 14·18 on the other two. An equally satisfactory rate of speed was maintained during her cruise on the 6th, which comprised a run from Southampton to Cowes, thence to Ryde Pier, Portsmouth Harbour, Spithead, a few miles down the Solent to the westward, and back; and, notwithstanding the unfavourable state of the weather—a strong E.N.E. wind blowing, with rain—the performances of the gallant little ship were most satisfactory. The design of this vessel secures an unusual amount of comfort to passengers, accommodation for first and second-class being provided in large deck houses recessed down below the deck, fitted with plate-glass windows, and heated by hot-water pipes. This mode of construction provides ample ventilation in summer and warmth in winter, while passengers can enjoy an uninterrupted view of the scenery without exposure to wet or stormy weather. The roof of the deckhouses forms a pleasant promenade. The *Lord of the Isles* is the first vessel of a new fleet belonging to the Southampton, Isle of Wight, and Portsmouth Improved Steamboat Company, and will shortly commence running regularly on the station.

The French Government is about to contract with the Messageries Imperiales for a monthly line of steamers to India and China. There are to be twelve vessels going from Suez, with five branch routes, whereby Penang, Singapore, Saigon, Reunion, Mauritius, Madras, Pondicherry, Calcutta, Manilla and Batavia, Hong Kong and Shanghai, will be severally reached. Government accords a subvention of £240,000 a year. This amounts to the very high subsidy of £1 per mile. It will be found out, that a very powerful fleet, and numerous docking and coaling stations will be required. It is somewhat singular that a scheme, which in consequence of the promised extent of support from the Government, becomes almost divested of a commercial character, has attracted so little notice here. Messrs J. & G. Thomson of Govan, Glasgow, have just launched the *Fingal*, a screw steamer built for Messrs D. Hutcheson & Co., a firm which has done so much for the opening up of the West and North Highland steam navigation. A mention of the *Iona* alone is sufficient to show what this indefatigable firm has done to insure speed, comfort, and generally superior accommodation in every way, far beyond all to which we were accustomed prior to their era. It is not too much to say, that there is no European steamer at all fit to be compared with the *Iona* for river and coast navigation. The length of the *Fingal* is 180 feet; depth 25 feet; burthen 600 tons. Her engines are of 120 horse power; and her condensers are upon the "surface" principle. Messrs Thomson have also on the stocks, for Messrs Hutcheson & Co., a paddle-steamer, to be called the "*Fairy.*" This vessel, which is far advanced, is intended for the traffic of the Caledonian Canal. It is built somewhat on the American principle, or "housed," the saloons and cabins being placed on the deck, which will enable the passengers in wet or cold weather to sit comfortably sheltered, and look around them on every side. The spar deck above affords a spacious promenade. This is a vast improvement, and will greatly conduce to the comfort and luxury of the many who seek this route. Messrs Tod & M'Gregor, also of Glasgow, have just launched a screw steam yacht, of 110 tons, for Dr Livingstone, the celebrated African traveller, and intended for the navigation of the river Shire, above the Merchiston Falls, and of the great Lake Nyassa. She was christened the "*Lady Nyassa.*" The "*Lady Nyassa*" is to have a pair of high pressure direct-acting engines, and will have the novelty of two screw propellers on separate shafts. She has been built for a light draught of water, being intended, when ready for sea, to draw not more than 7½ feet; and as she has to be taken to the river Zambesi in pieces, she has been constructed on a new principle, and fastened with screw bolts, so as to be fitted up without riveting, on reaching her destination.

THE DEFIANCE.—The following are the dimensions of the screw liner *Defiance*, recently launched at Pembroke:—Length between perpendiculars, 254ft. 9in.; length of keel for tonnage, 219ft. 11½in.; breadth, extreme, 55ft. 4in.; breadth for tonnage, 54ft. 6in.; breadth moulded, 53ft. 8in.; depth of hold, 24ft. 6in.; burden in tons, 3,475⅓, and nominal power of her engines, 800 horses.

THE THAMES DEFENCES.—The principal batteries of the sea defences at the entrance to the river Medway are all to be armed with 100-pounder Armstrong guns as rapidly as these can be supplied from the Government factories, which will be mounted in lieu of the 68-pounder 95cwt guns with which the batteries at the Nore are at present all armed. The new fortifications which the Government has ordered to be erected at Garrison Point will shortly be commenced, the building of which will be proceeded with day and night, in order that the works may be completed as rapidly as possible. The steam floating battery *Thunderbolt*, 16, 200-horse power, has taken up her position off Shornmeade, on the Kentish side of the river. The armament of the two floating batteries the *Ætna* and *Thunderbolt*, now anchored in the Thames at Coalhouse Point and Shornmeade, for the protection of the river, is most powerful, each battery being provided with 16, 68-pounders, each of 95 cwt. Of this armament two of the guns fire forward, and two aft, leaving six each for the starboard and port broadsides. If required, however, the whole battery of broadside guns can be brought into action on either side of the floating battery, each having been constructed with that view. The broadside of the *Thunderbolt*, as she lies of Shornmeade, will bear exactly with the Lower Hope Reach, and the two fore and aft guns, as the case might be, will bear up Gravesend Reach. The *Ætna* is moored about have a mile below the *Thunderbolt*, on the right hand side of the river, at Coalhouse Point, on the Essex shore, in a line with West Tilbury Church. This battery's broadside of 12 guns will have a direct bearing up Gravesend Reach, and her two fore and aft guns will sweep Lower Hope Reach in conjunction with the 12 broadside guns of the *Thunderbolt*, so that every vessel attempting to push up the Thames from the Nore would come under the close and heavy cross fire of both floating batteries.

NATIONAL LIFEBOAT INSTITUTION.—On the 2d inst. a meeting of this institution was held, his Grace the Duke of Northumberland, K.G., President of the Society, in the chair. A reward of 6*l* 10*s* was granted to the Crew of the lifeboat at Middlesburgh, for saving the Crew of four men of the schooner *Oregon*, of Stonehaven, which had sunk in Tees Bay. Rewards amounting to 19*l* 10s were also given to the Crews of the lifeboats stationed at Margate, Drogheda, and Arklow, for putting off to vessels in reply to signals of distress. The silver medal of the Institution was voted to Captain Goss. R.N., Inspecting Commander of the Coastguard at Queenstown; and to John Slarke, together with 2*l* to the latter, and 16*l* to their boat's Crew of night men, for putting off in a coastguard boat, and rescuing 12 out of 13 of the Crew of the Austrian brig *Uredon*. The silver medal was also voted to Lieutenant Hutchison, of Kingstown, and Lieut. Parsons, of the 35th Regiment, for services in aiding to save three out of four of the Crew of the brigantine *Industry*, of Whitehaven, which was wrecked off Kingstown on the 9th Feb. It was reported that the institution had, during the past month, sent new lifeboats and transporting carriages to Whitby, in Yorkshire; and to Irvine, in Scotland. A powerful lifeboat would also be sent in a week or so to Selsy, near Portsmouth. Lifeboats were also being built by the institution for Tynemouth, Scarborough, and other places. It was reported that a benevolent gentleman had intimated his intention to bequeath to the institution 3,000*l*. under certain conditions, to enable it to place two or three lifeboats on the coast. In connection with this most admirable Institution, we may notice that a very praiseworthy example has been set by the late Mrs Shedden Watson, whose executors have just paid the National Lifeboat Institution 450*l*., being the amount of a legacy left by her to the society to found a lifeboat station in memory of her deceased son, Lieutenant Shedden, R.N.

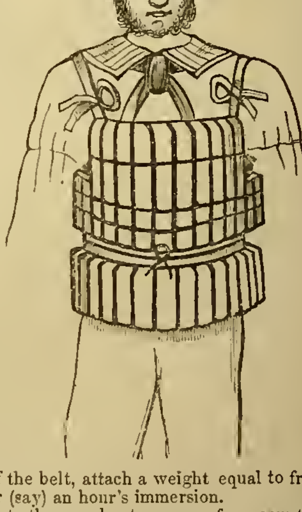
THE LIFE-BELT OF THE NATIONAL LIFE-BOAT INSTITUTION.

AMONGST the means in use for affording succour to shipwrecked persons, not the least important article is a life-belt, or life-jacket as it is sometimes termed. A recent melancholy accident to a life-boat not belonging to the National Lifeboat Institution, when eleven men out of twelve who formed her crew perished, by having a life boat of an inferior description, whilst the only man saved, who could not swim one yard, had on an efficient belt, has attached to the subject a certain amount of public interest. We think, therefore, that we shall serve that interest by publishing a descriptive sketch of the life-belt worn by the fortunate survivor of the life-boat's crew above referred to, similar belts to which have been for the past seven years provided to the life-boats' crews of the National Life boat Institution.

The qualities which we conceive a boatman's life-preserver—and it as such we particularly have in view—should possess, are—1st, It should contain as much buoyant power as would support one man, with his head and shoulders above the water, although he might be disabled by injury or otherwise from swimming, or as would enable a man, if a swimmer, to support with ease another person beside himself. 2d, It should not be liable to lose its buoyant property by any accident to which it might be exposed, such as by a heavy blow, or by absorption of water. 3d, It should be of such a pliant, elastic, or soft nature as to conform readily to the shape of the wearer, and not to prevent the free use of the arms and upper part of the person, or to confine the chest, so as to impede the action of the lungs, on which the capability of enduring prolonged exertion or fatigue much depends.

It seems to have been generally supposed that the least possible amount of buoyancy which would suffice to raise the mouth above the surface of the water was all that was required, and accordingly many of the belts which are sold in the shops have only buoyant power equal to 6, 8, or 10 lbs. A little consideration will, however, make it apparent that the largest amount of buoyancy which can be obtained without seriously incommoding the wearer, and depriving him of the free use of his limbs, is no more than is requisite. The belts as used by the crews of the boats of the National Life-boat Institution, and invented by Captain J. R. Ward, R.N., its Inspector of life-boats, have much greater buoyancy than any kind of boat-belt previously introduced, and have other important peculiarities.

The buoyant power is from 20 to 24 lbs. The cork is uncovered, so that its quality can always be discerned, and it is divided into many narrow pieces, each of which is separately sewn on to a strong linen or duck belt, covering the body from the armpits to below the hips. These pieces of cork are distributed in two rows, one above and the other below the waist, the belt being secured closely about the body by strings passed round the waist between the two rows of corks, and being further secured by other strings crossed over the shoulders, as men's trowsers braces are worn. This division of the cork into two rows is one of the most important distinctions of those belts, as a sufficient quantity of cork to afford double the buoyancy of the ordinary cork-belts can be then attached, and in a manner which is much less inconvenient to the wearer than the lesser quantity or one row, which, not being secured round the waist but round the chest, interposes with the free action of the lungs, and the muscle of the shoulders and arms. By this arrangement in these belts, the trunk of the body is enveloped in cork, and attached so as to be perfectly flexible, and to allow of all the ordinary movements of the body without inconvenience, whilst it affords great protection to the body against injury from a blow, and is a preservative of its heat in cold weather. To test the buoyancy of the belt, attach a weight equal to from 20 to 24 lbs, which it will restrain after (say) an hour's immersion.



We consider it would be a great boon to the merchant seamen of our country, if every merchant vessel were to have on board, and stowed in a chest on the upper deck, as many of these belts as formed the number of her crew, so that in the event of their having to desert their vessel from wreck, leakage, collision, or fire, and take to their boats, each man might be supplied with an apparatus which, as it would make it impossible for him to sink, would doubtless be often the means of saving his life.

Blasting Powder.—A patent has been taken out in Belgium for the manufacture of blasting powder from spent tan bark, which may perhaps prove to be of great service in mining and earthwork operations, for the effect of the powder is said to be very great, and its cost to be very moderate. The magnificent promises of the discoverers of gun cotton, however, make us rather sceptical as to the merits of this new invention, especially as the description of the process of manufacture hitherto published is vague and unsatisfactory. Nevertheless the production of a cheap blasting powder is so important, and the conversion of the spent tan bark would confer so great a boon on the leather trade, that we have felt it to be our duty to call attention to the subject.

Imports of Australian Gold.—This colony continues to yield large quantities of the precious ore. The following ships are on their way home:—the Copenhagen, with 51,206 ounces; the Empress of the Seas, 5,010 ounces; the Owen Glendower, 14,157 ounces; the Kleher, 8,872 ounces; the Kent, 26,054 ounces; and the Marco Polo, 6,570 ounces. There are besides 14,562 ounces brought *viâ* Suez, by the mail steamer, making a total of 126,461 ounces, worth about £506.000. The Calliance and the Southampton are also out, the former with £126,000, and the latter with £86,000.

Railway Bills.—After hearing evidence, the committee passed the preamble of the Cork and Youghal Railway Bill for sundry extensions, and to enable them to raise a further sum of 60,000*l.* for general purposes. The Bill of the London and North-Western, Lancaster and Carlisle, and Caledonian Railways, for mutual arrangements, was passed, together with the Bill of the West Cheshire, for extensions to the Cheshire, Midland, and Birkenhead Railways, at an estimated cost of 300,000*l.* The standing orders not previously complied with in the case of the Metropolitan Railway (Extension to Finsbury-circus) and Victoria Station and Pimlico Railway have been complied with.

West Midland.—The total traffic receipts of this company for the fortnight ending the 7th of April amounted to £13,635, and for the corresponding fortnight of 1860 to £13,411. The expenditure amounted to £6,121, or at the rate of 44·89 per cent., while the expenses for the corresponding fortnight of 1860 amounted to £5.668, or at the rate of 42·26 per cent. The aggregate receipts for the first six fortnights and 13 days of the half-year amounted to £90,838, as against £88,494, for the corresponding seven fortnights and one day of the previous year. And the aggregate expenses for the first six fortnights and 13 days of the half-year amounted to £45,727, or 50·33 per cent., as against £39,690, or 44·85 per cent., for the corresponding seven fortnights and one day of the previous year.

Dutch Rhenish.—The receipts on this line for the fortnight ending April 15, 1861, amounted to 6,866*l.*, and for the corresponding period of last year to 6,248*l.*, showing an increase of 618*l.* in favour of the present year. The receipts since the 1st of May, 1860, including the above, amounted to 168,825*l.*, showing an increase, as compared with the corresponding period of the preceding year, of 17,811*l.* The working expenses for the fortnight amounted to 2,776*l.*, 40·43 per cent. of the receipts, and for the corresponding period of last year to 2,369*l.*, or 37·90 per cent. showing an increase of 407*l.* The working expenses from the 1st of May, 1860, to the 15th of April, 1861, amounted to 65,159*l.*, or 39·59 per cent. of the receipts. The working expenses for the year 1859 60 were 40·02 per cent.

Military Pontoons.—Mr H. Grnndt, of St Louis, U.S., has introduced a new arrangement of pontoon, suitable for military purposes, or for the transport of persons or goods across rivers, or sheets of water. This pontoon consists of a wooden vessel of any form that will admit of its sides readily folding over on to the bottom, and the bottom folding on to itself, so that the pontoon, when not in actual use, is capable of being folded up into a small space, easy of transport. When required for use, the folded parts are opened out, and the water is excluded from entering by strips of gutta percha, caoutchouc, or other suitable water-tight packing medium, being laid along the contiguous surfaces at the joints, or by employing some similar contrivance, so that, when opened out, the water will be effectually excluded.

French Railways.—From the accounts of two of the great railways of France—the Northern and the Eastern—it appears that the total receipts of the Northern Company were last year 2,424,281*l.*, and the working expenses were 931,701*l.*, leaving a balance of 1,493,583*l.* From this amount various deductions had to be made for interest on loans, &c., but dividends of 2*l.* 15s. were declared on the old shares, and 1*l.* 15s. on the new shares, carrying forward a balance of 234*l.* These dividends on 20*l.* shares are at the rate of 13 and 8 per cent. respectively. The Eastern Company earned on its railways in 1860 2,514,428*l.*, as compared with 2,336,779*l.* in 1859, and the working expenses were 1.139,283*l.* and 1,078,591*l.* respectively. The net balance available for dividend after payment of other charges of all kinds was 798,356*l.* and out of this sum a dividend of 1*l.* 12s. 6d. per share, or 8 per cent. per annum, was declared.

South Austrian and Lombardo-Venetian.—The total receipts on the South Austrian line for the week ending the 29th April amounted, on 1,004 miles, to 43,272*l.*, against 26,184*l.*, on 687 miles, in the corresponding week of 1860, showing an increase in the mileage of 317 miles and in the receipts of 17,088*l.* The total receipts from the 1st of January to the above date amounted to 611,956*l.*, against 463,199*l.* for 3,373*l.*, showing an increase of 1184*l.* The total receipts from the first of January to the above date amounted to the corresponding period of 1860, showing an increase of 148,757*l.* The total receipts on the Lombardo line for the week ending the 29th of April amounted, on 156 miles, to 4,558*l.*, and for the corresponding week of last year, on 139 miles, to 73,029*l.*, against 63,064*l.*, showing an increase of 9,964*l.* The total receipts on the Central Italy branch, from Plaisance to Bologna, 91 miles, for the week ending the 29th April, amounted to 3,293*l.*, and for the corresponding week of last year to 2,351*l.*, showing an increase of 942*l.* The total receipts on this branch line from the 1st of January to the 29th of April amounted to 44.912*l.*, against 34,279*l.* for the corresponding period of 1860, showing an increase of 10,633*l.*

Rifled Ordnance.—Captain Blakely, a high authority on fire arms says, Rifled barrels were in use more than two centuries before Mr Robins explained the cause of their throwing bullets more accurately than smooth bores; and nearly another century elapsed before elongated projectiles were introduced, although that extraordinary man clearly pointed out the advantages to be derived from them. Progress has lately been more rapid. Only thirty years elapsed between Captain Norton's first successful experiments, and the adoption in this country of his system of firing elongated bullets so constructed as to enter the barrel easily, and to expand on the ignition of the powder so as to fill the grooves of a rifle. Mr Robins suggested elongated bullets; Captain Norton first overcame those difficulties in their use which had prevented Mr Robius from putting into practice his own views. Hundreds, I may say thousands, have improved this system in detail; no one has yet succeeded in altering it in any material feature. The names of Robins and Norton will, therefore, I venture to predict, be recorded in history long after the discoverers of the best proportions of tallow and wax for lubricating wads, and the rival advocates, male and female, of screw breech-plugs have been forgotten.

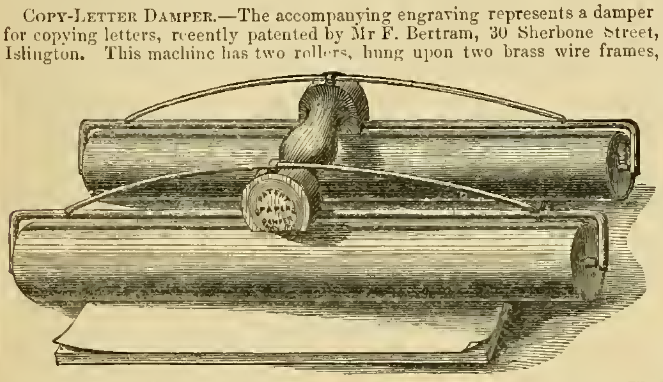
Illinois Central Railway.—Mr T. E. Walker, the chairman of the executive committee, states that there were on the 2d ult., 5,000,000 bushels of grain at Chicago, of which one-third was stored in the company's warehouses. The traffic on the Railway for the month of March amounted to 232,887 dols., against 209,794 dols., for March, 1860, showing an increase of 22,893 dols. In the company's land office the sales for March were 179,653 dols., making 479,901 dols., for the first quarter of 1861, against 98,920 dols., for the first quarter of 1860, showing an increase of 380,981 dols. The collections for the month of March were 61,130 dols., making for the quarter 184.827 dols., against 122,439 dols., for the corresponding three months of 1860. He states that upwards of 3,500,000 bushels of grain had passed over the line in the first quarter of the present year. The total receipts from traffic during that period amounted to 831,688 dols., from cash collected in the land department to 184,827 dols., and the amount of land sales to 479,901 dols., making the business of the company amount together to 1,496,416 dols., for the first quarter of 1861, against 802,536 dols., for the same period of 1860, and to 684,560 dols., for the same three months of 1859, showing an increase of 693,880 dols., over the first quarter of 1860, and of 811,856 dols., over the same period of 1859.

Hydrostatic Press.—A novel arrangement of this most useful machine has been brought out by Mr G. Tidcome, of Waterlord. This hydrostatic press is more particularly applicable to the pressing of what is known in paper-making as "half-stuff," to the compressing of pulp in the manufacture of papier maché, and generally to the compressing of any moist or soft substance into the form of a cake or block. According to this invention, it is proposed to construct the box which contains the material, or substance to be pressed, of wrought-iron, in the form of a solid ring, or a rectangle, with rounded corners, or other convenient shape, but without any door or opening for the extraction of the compressed, material or cake. This box, which is without top or bottom, is laid upon the table of the hydrostatic press, and the "half stuff," or other substance to be pressed is placed within it. The table is now made to rise, and the material in the box is forced against a projecting plate on the head of the press, whereby it becomes compressed, and the liquid or moisture discharged. The box, which is connected to a counter-weight by a chain, is held in this elevated position against the head of the press by means of a lever-catch, which engages with the counter-weight, so as hold it down. The table of the press is now allowed to descend, and in doing so it draws the compressed cake along with it out of the bottom of the box, which remains fixed. The table having descended sufficiently for to admit of the cake being received easily therefrom, the counterweight is released, and the box descends again on to the table, in readiness for another charge.

Manufacture of Steel.—A new mode of manufacturing steel, direct from scrap-iron, has been proposed by Mr G. Nimmo, of Airdrie. The scrap-iron, or bar-iron, is cut into small pieces, and placed in a crucible, and the carbonizing materials are added thereto. The contents of the crucible are subjected to the heat of a furnace, the action of which is assisted by the aid of a blast of air, either heated or at the natural temperature. The carbonizing materials consist of charcoal, or other carbonaceous matter, and the black oxide of manganese, which are added to the scrap or bar-iron. For example, if it is desired to manufacture steel in quantities of forty pounds of scrap or bar-iron to each crucible, that quantity of metal is weighed out and placed in the crucible, to which is added charcoal, or other suitable carbonaceous matter. When charcoal is used, it is in the proportion of one ounce of charcoal, or thereby, to every four or five pounds weight of iron. The black oxide of manganese is added to the contents of the crucible in the proportion of one ounce of the oxide, or thereby, to each ten pounds weight of the iron. If larger or smaller quantities of iron are used, the proportions of the carbonizing materials are increased or decreased in a corresponding ratio. The crucible is, with its contents, exposed to a strong heat, in a suitable furnace, for one hour and a half, the process of conversion being assisted and facilitated by the introduction of a blast of air, either heated or at its natural temperature. The air is caused to play over and upon the fuel surrounding the crucible, and it may be advantageously introduced into the furnace from below the crucible. In about an hour and a half the crucible is withdrawn from the furnace, and the contents are poured into ingot moulds, or other forms in which the metal may be required. After going through this short and simple process, the iron is converted into steel, suited for the purposes to which that metal is ordinarily applied.

Utilization of Chemical Products.—In the manufacture of soda a very large quantity of waste material is produced, which contains various compounds of sulphur, as well as potash, soda, and ammonia. Messrs Townsend & Walker, of Glasgow, have turned their attention to the utilization of these matters. Their improvements also relate to the recovery of oxide of manganese from the chloride of manganese, obtained as a bye-product in the manufacture of chlorine, and from other soluble salts of manganese. Also, to the obtaining of the sulphite hyposulphite of lime from soda waste, and other generally similar products. Under one process for recovering sulphur from soda waste, the material is lixiviated with water in any convenient manner, and the solution is mixed with chloride of manganese liquor, which has been previously freed from iron. The two solutions are mixed in such proportions as will effect the desired decomposition. The proportions, as a general rule, are about nine gallons of waste liquor of a specific gravity of 1·05 to one gallon of manganese liquor, specific gravity 1·20. As a rule, it is preferred to have the mixture slightly alkaline. The precipitate which is thrown down consists of free sulphur and sulphate of manganese. This is allowed to subside, and the supernatant liquor is drawn off or run into a sewer. The precipitate is collected, drained upon filters, and cut into cubes of two or three inches, which are dried at a temperature not exceeding 212° Fahrenheit. The dried precipitate is now ready to be used for the manufacture of sulphuric acid, which is by preference effected in apparatus similar to that ordinarily employed in burning pyrites. The residue, after being burnt, consists chiefly of the oxide of manganese, with a trace of sulphur. For the production of sulphite or hyposulphite of lime, the solution from the soda waste is evaporated to dryness, and then burnt in a furnace, the residual mass being the product desired. Under another modification, the solid bye or waste products are treated by boiling or agitation with the soluble salts of manganese, so as to produce a similar precipitate to that obtained by solution alone.

Copy-Letter Damper.—The accompanying engraving represents a damper for copying letters, recently patented by Mr F. Bertram, 30 Sherbone Street, Islington. This machine has two rollers, hung upon two brass wire frames, and joined together through the cross handle for working the machine. The roller nearest the eye is completely covered with several turns of blotting-paper, and the other, which is covered with soft felt, may be termed the damping roller. A small screw, shown at one end of this roller, serves to regulate the quantity of water flowing from the interior of the roller to the felt covering outside, which, when perfectly saturated, may be applied to the copy letter paper by the operator. The following blot-sheet roller removes any superfluous water left on the felt roller, and evenly distributes that which the first roller had just damped, so that many sheets may be prepared by the operator speedily and effectively.



British and French Industry.—The French Government has offered a large subsidy to the producers of the country to help them in the industrial struggle with us. In the case of a sum of £1,600,000, offered by the State in shape of loans for improvements in machinery and productions, 500 applications, amounting to double that sum, have resulted; of these 272 were struck off, and 200 were admitted for an amount of £1.540,000; 27 of these are from the iron and metal trades; sum allowed £330,000; 88 for yarns and tissues, £600,000; 5 for roads and conveyances, £48,000; 11 mines, £152,000; 18 machines, £56,600; 6 sugars, £130,000; 45 for papers and sundries, £163,300. 162 of these loans are covered by hypotheca, 32 without security (amounting to £216,000.) Loans to be repaid by annuities for ten or twelve years. It is difficult to see what particular benefit to the borrower results from this scheme. Loans on hypotheca are always comeatable; and probably the 32 concerns above mentioned could, on their own credit, borrow a few million francs any day. Long reports of the general meetings of the great speculative companies appear daily in the papers. Among these the Credit Mobilier figures: with its paid-up capital of £2,400,000, it shows a profit which, after all expenses, allows a dividend of 10 per cent. The shares are up 8 per cent. in a week. The Société Immobilièr, with a capital of £1,000,000, shows large profits from lands and houses—div., 10 per cent. The principal property of this company is the Hotel du Louvre. The land buildings of this gigantic concern cost £460,000, and the furniture £96,300; the revenue from shop rents is £11,860; and the gross drawings of the hotel, £101,000, or about £285 per day; the net profit on the hotel alone being £44,600, in addition to the shop rents. The same company are going to erect another immense establishment, to be called "Hotel de la Paix," on the Boulevard des Capucines, opposite the Rue de la Paix, and near the site of the new Opera. This little inn will accommodate 800 travellers at a time, and will be extremely magnificent, and also, probably, very dear. There are already 1200 hotels in Paris, mostly in a flourishing state.

Terrestrial Magnetism.—The director of the Collegio Romano at Rome, Father Secchi, has just published an interesting account of the results obtained from a series of observations made with a set of new magnetic instruments of great delicacy recently added to the establishment alluded to. Besides the periodical variations to which these instruments are subject, there are extraordinary variations also which the professors of the Collegio Romano have watched with the greatest attention. The perturbations of the needle under the influence of the aurora borealis have often been alluded to by us; Father Secchi now states that the perturbations of his instruments at Rome were found to be contemporaneous with the aurora borealis observed in Guadaloupe and Cuba. Father Secchi likewise mentions other variations not hitherto observed, consisting in slow oscillations, extending over several days, and the theory of which he comprises in the following propositions:—1. Besides the magnetic perturbations hitherto known, there are certain fluctuations by which the magnetic force increases for the space of several days and then diminishes much more suddenly than it increased; 2. These variations sometimes have the effect of completely paralysing the diurnal variation, and may even change it from positive to negative, since they do not follow the horary laws of the other variations; 3. They are intimately connected with atmospheric storms; 4. Not only great showers, but also certain rapid atmospherical variations of temperature, or sudden accumulation of clouds, have been found to influence the horizontal force of magnetism especially; 5. When these variations have occurred without any of the preceding symptoms, the latter soon make their appearance afterwards; 6. The horizontal intensity increases under the influence of northern winds, and diminishes under that of southern ones; and 7. The horizontal component force follows the law of the barometer. These propositions are important in a theoretical point of view, because they establish the intimate connection existing between magnetic and meteorological phenomena; and, practically, because they may be useful in announcing the approach of storms.

Steam-Hammers.—A peculiarly effective arrangement of steam-hammer has just been patented by Mr David Jay, Engineer, Manchester. Within the steam cylinder a long block piston is accurately fitted, to serve the double purpose of being both a piston and a valve, which, in conjuction with a new cylindrical balanced valve, fitted in the valve chest, the length and number of strokes is thus simply regulated. This new valve is constructed on the principle of the well known "cored D slide valve," which has four faces in its length. To correspond with these faces, and to render the valve equilibrium, Mr Jay adopts four pistons, two as it were on each side of the valve, between which the exhaust through the body of the valve communicates the upper and lower ports of the steam cylinder with the exhaust port alternately. Between the two central pistons, and around the body of the valve, the induction steam is reciprocally reversed by the direct action of the steam from the steam cylinder, which is regulated by the long block piston of the hammer itself. In the metal constituting the body of the steam cylinder, between it and the valve chest a circular port is formed and fitted with a plug-rod working parallel to the axis of the cylinder, through a stuffing box alongside of the hammer piston-rod stuffing box. This circular parallel port commuicates with the slide valve chest by means of a small port formed at its upper end, as also the steam cylinder by a series of holes bored regularly throughout its whole length. This plug port, as we may term it, is fitted with an accurate parallel plug-rod, which, when drawn out or pushed in, so many of the holes forming the communication between the steam cylinder and the valve chest are thus opened and closed so as to regulate the length of the hammer's stroke. When steam is admitted below the piston of the hammer, the long block piston covers the whole series of holes, and so soon as it rises to that one which it first opened by the position of the plug-rod, the steam rushes into the valve chest below the slide valve and causes it to ascend, thereby reversing the induction and exhaust ports, and allowing the hammer at this point to fall freely. A small port between the upper end of the slide valve chest, and the upper end of the steam cylinder, serves as an exhaust for the piston slide valve, which, when relieved from the steam pressure underneath, again gravitates to its lower position. The speed of this hammer is regulated by a distinct valve on the steam pipe outside the valve chest, and is so set that the quantity of steam passing through will just hold the hammer at about half-stroke. This balanced piston slide valve being wrought by the direct action of the steam, is a novelty in steam hammers which we may illustrate and more particularly enter into its merits in our next number.

New Diving Apparatus.—A correspondent writing from Munich says, at Baron Liebig's, Mr Bauer, "submarine engineer," recently exhibited his model of a new diving apparatus for exploring the bottom, for pearl or coral fisheries, for bringing up samples of plants or seaweed, for laying the foundation of breakwaters or the piers of bridges, or for raising sunken vessels and treasure. A more practical opportunity of testing his invention has just been afforded him by a commission to raise the steamer which sank in the Lake of Constance, but every one who saw the working of his small model was perfectly satisfied. Mr Bauer has also taken out a patent in England, and he was two and a half years in the country endeavouring to get the Admiralty to adopt his invention. Perhaps the Committee, which is appointed to investigate the Admiralty, may wish to know of this case of their patronage; and perhaps Sir Baldwin Walker, whose flight has been so much commented upon, may remember refusing to notice Mr Bauer's discoveries because the Admiralty preferred fighting above water to fighting below it.

The objections to the diving-bell and to the helmet and diving-dress are too well known to need repetition. Mr Bauer's invention gets rid of the objections already existing, without bringing new ones into play. His apparatus is completely closed; the diver enters through a door at the top, which is afterwards hermetically sealed, and he takes down air enough to last six or seven hours, after which it can be renewed by means of tubes communicating with the ship on the surface, or purified by the introduction of oxygen. The apparatus is of a cylindrical form, with a double bottom for the reception of water-ballast, which is pumped in or out from within, with bull's eyes in front, on the sides, at the bottom and overhead, a screw-propeller worked by band from within the chamber, a rudder and a smaller screw to make it revolve on its axis. Besides these means of locomotion, it is fitted with a pair of paddle-wheels for moving along the bottom, with an anchor to resist powerful currents, and with weights which can be suddenly dropped if the conducter wishes suddenly to rise. For digging up plants, for pearl or coral fishery, or for raising specie, the apparatus is fitted in front with shovels, scoops, spoons, or tongs, which are worked from within the chamber. For raising sunken vessels, balloons are used of strong material, such as alternate layers of canvas and caoutchouc, and inclosed in a network of stout cords with an iron ring at the bottom. These balloons are lowered empty to the apparatus, and are fastened round the vessel to be raised to an iron pin previously driven in by the operator. They are then inflated by a force-pump from the ship above, and as they are all open at the neck the air within regulates itself in proportion to the pressure of the water without risk of bursting the balloons. As soon as all the balloons are fastened round the ship and inflated the ship rises of itself,—a great improvement it must be admitted on all the previously existing means of operation. Mr Bauer showed all these parts of his invention with a ballon and a considerable weight at Baron Liebig's with perfect success. He took the stone, which bore the same proportion to his model that a large stone would bear to his apparatus, lowered it gradually to the spot determined, made it advance under water, on the surface, made it sink gradually while moving ahead, and then made it rise by the inflation of a balloon. I could not but admit the entire success of the apparatus, and regret that England did not see fit to secure it. But when Mr Bauer, on meeting with a refusal from the Admiralty, desired to offer it to private speculation, that sagacious Board informed him that they would not allow its introduction into England because the Act of 1834 forbade the adoption of anything which might be used for smuggling, and his apparatus was most eminently fitted for that purpose.

Fig. 1.

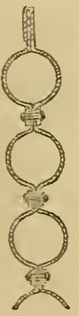


Fig. 2.

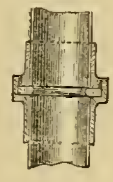


Fig. 3.

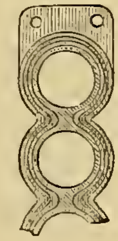


Fig. 4.

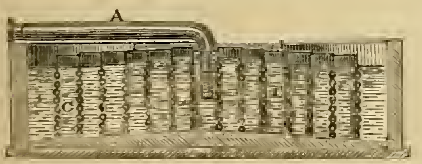
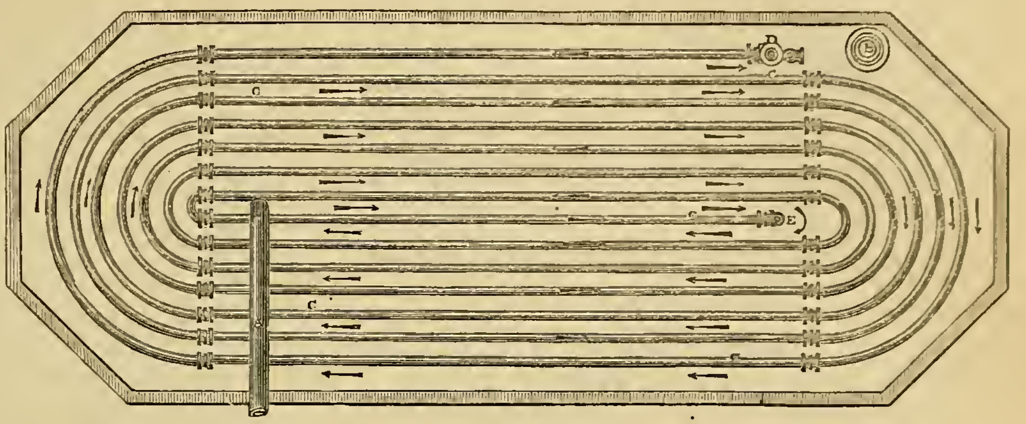
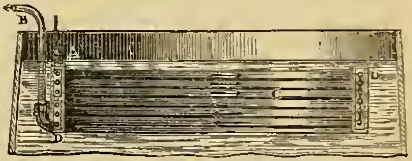


Fig. 5.



Refrigerators.—The accompanying illustrations represent modifications of Mr Robert Davison's improvements in the arrangement and application of corrugated plates to various useful purposes. Fig. 1 shows two corrugated plates connected together according to this invention; three corrugations are shown, but any number can be made to face each other in a similar manner. The plates are made, say in eight or ten feet, or any other lengths, and are riveted or soldered at the top and bottom edges, with an occasional rivet in the intervening spaces between the corrugations. The tubes at both ends are fitted with a metal flange box with an india-rubber ring or other packing inside, and are united by screws or bolts to a similar box, as shown at figs. 2 and 3, which boxes are fitted on the semicircular bends, and the whole is so placed as to cause a constant and continuous flow of cold water through the tubes, while the hot liquid is passing in a contrary direction outside. Figs. 4 and 5 show in transverse vertical section and plan respectively, a refrigerator, with the pipes made, arranged, and connected together in the manner before described. The arrows show the course of the water and wort; the supply of these fluids is regulated by means well understood. According to this arrangement it is optional which of the fluids (the hot or cold) is made to pass through the tubes, but as the external surface of the tubes is accessible at every part. it is preferred, for the sake of cleanliness, to cause the hot worts to flow outside. The figs. show the form of refrigerator preferred, but the tubes may be jointed together in continuous straight lengths, or in any other form best suited to the position in which the cooling is required to take place. A, is the wort supply pipe, B, the exit pipe, C, are the pipes through which the cold water circulates, D, is the inlet, and E, the exit for the water. The sides of mash tuns and other vessels may be formed entirely of the double corrugated plates, and have either hot or cold fluids passed through them for attemperating purposes. Figs. 6 and 7 show section and plan views of a refrigerator or attemperator for cooling beers in a fermenting state. It consists of two lengths of the double corrugated plates bent to a semicircular form, and united by metal boxes, as before described. The cooling medium in this instance passes through the tubes, and by means of a stop in one of the boxes, it is caused to travel twice round the circumference of the refrigerator before it makes its exit. The arrows show the course of the cold fluid. The inventor prefers to form the refrigerators of copper, and owing to the rigidity which is given to this metal by corrugating it, the weight need not exceed 16 ounces per foot, in many cases 12 ounces are sufficient. The plates may be either tinned or electro-plated. The double corrugated plates are also applied to roofing, in contradistinction to single plated roofing. which is known to be very oppressive in warm weather. The air contained between the double plates forms a good non-conductor of heat, besides the roofing is rendered much more rigid and more suitable to large spans, without a corresponding demand for ties or braces than when single plated roofing is employed. The holders formed by the corrugations may be made to contain hot or cold air, as required. Again, for superheating steam, holders formed of these double corrugated plates will be found of great value. Sets of the holders may be placed in the flues in the chimney, or in any other passages for waste heat from furnaces.

Fig. 6.



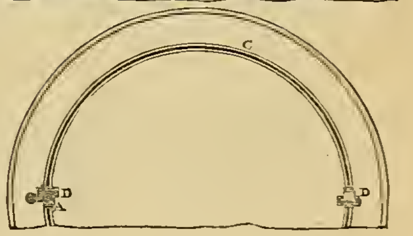


Fig. 7.

Compressed Air in Mining.—Amongst mining engineers the question of the introduction of machinery for the compression of air in the downcast shafts instead of exhausting the air through the upcasts is beginning to attract attention; and it has even been suggested that the good effects of compressed air on the muscular and mental energies of the workmen who work in it would constitute one of the recommendations of that system. It seems, however, very questionable whether in a properly ventilated mine any appreciable compression of the air could be maintained; and even if that were possible, the results of the works lately executed in sinking the foundations of the bridges over the Rhine at Kehl, and over the Theiss at Szegedin, show that there is so much danger to the men working in highly compressed air that it is by no means desirable to attempt to introduce such a method if it could possibly be avoided. In sinking tubular foundations through light sands charged with water, there seems to be no more economical mode than the introduction of compressed air; but the workmen who are thus employed suffer greatly from neuralgia, determination of blood to the head and lungs, and from other diseases produced by a surexcitation of the circulation; under no circumstances are they able to work in air of a pressure equal to three atmospheres for more than six hours at a time. The Kehl Bridge above alluded to has recently been opened, and it forms a very striking object from the banks of the river, although far from being as noble a structure as the bridge over the same river at Cologne. The Kehl Bridge has three fixed spans of 66 feet 7 inches each, and two turning bridges, leaving four openings of 84 feet 9 inches each; whereas the Cologne Bridge has four spans of 322 feet 9 inches each, at 50 feet clear height above summer level of the river; the difficulties overcome in the foundations of the former structure were, however, much greater than those of the latter. Much information with respect to these works will be found in the *Annales des Ponts et Chaussées*, and in the *Nouvelles Annales de Construction*. We may return in a special article to the modern practice of bridge building, for it presents some of the most remarkable illustrations of the application of practical mechanics to be met with in the whole range of art.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

30th March and 1st *April*, 1861.

780. Guiseppe M. Coppo, Rue Guillon, Paris—Improvements in machinery for fulling felt hats and other felted goods.

781. James J. Field, Holloway Place, Holloway—Improvements in apparatus for evaporating in vacuo.

782. William Simons, Renfrew, Renfrewshire—Improvements in or connected with ships or vessels.

783. John Griffiths, Richmond Park, Breck, Liverpool, Lancashire—Improved compositions or cements, and methods of applying the same to various parts of buildings and houses where slates, tiles, stones, and sheet metals have been used.

784. John Rattray, Manchester, Lancashire—Improvements in window frames, commonly called casements or French lights.

785. Thomas Sykes and Benjamin C. Sykes, Cleckheaton, Yorkshire—Improvements in steam boilers, and the prevention of incrustation therein.

786. John Cass, Bury, Lancashire—Improvements in steam engines and boilers, and in apparatus connected therewith.

787. George Barton, and Thomas Sear, Radford, Nottingham—Improvement in washing, wringing, and mangling machines, applicable also for dyeing or bleaching purposes, to be called "The Nottingham Washing Machine"

788. William D. Napier, George Street, Hanover Square—Improvements in the manufacture of rubbers for the human teeth and gums.

789. Jules J. L. Guiblet and Joseph Rambal, Wilmington Square, Clerkenwell—Improvements in keyless and other watches and time-keepers.

790. Daniel Sutton, Banbury, Oxford—Improvements in apparatus for hanging gates.

791. Carl A. Ehrenberg, Altona, Denmark—Improvements in the construction of ships' compasses.

792. Henry Medlock, Great Marlborough Street, Westminster—Improved means for preserving fermented liquors.

793. Thomas Simpson, Darfield Fireclay Works, Yorkshire—Improvements in apparatus for the manufacture of bricks.

794. Oswald Earle, Liverpool, Lancashire—An improved lubricating compound.

795. Robert Ridley, Low Wortley, and Joseph Rothery, West Ardsley, Yorkshire—Improvements in hewing or working coal and other minerals, and in the apparatus employed therein.

796. Joseph Briggs, Bridge Street, Blackfriars—Improvements in the manufacture of an artificial substance to be used as a coating or covering for stone, bricks, wood, or metal, and also in the method of and means for manufacturing flags, bricks, blocks, or paving from the said substance.

797. Gregorio Russo, Genoa, Sardinia—A new method of colouring as a substitute for saffron in the manufacture of cheese pastes and other articles in which saffron is employed.

798. George Edmondson, Manchester, Lancashire—Improvements in washing machines.

799. John Lowe, Glasgow, Lanarkshire—Improvements in the mode of applying colouring matter to certain textile fabrics and yarns in the process of dyeing and printing.

800. Richard Searle, Woodford Wells, Essex—The manufacture and insulation of telegraph cables and telegraphic wires in general, and of apparatus for laying marine telegraph cables.

801. Seymour de Sanges, Northumberland Street, Strand—Improvements in mattresses, cushions, and such like articles.

802 James E. Boyd, Hither Green, Lewisham, Kent—Improvements in motive power for sewing machines.

803. Robert James, Faversham, Kent—Improvements in reaping and mowing machines.

804. Richard A. Brooman, Fleet Street—An improved method of fixing lac and lac varnishes upon glass and ceramic ware. (Communication from Albert C. Gallais, Paris.)

805. James Gardner, Evershott Street—Improvements in portable buildings or structures.

806. William Palmer, Ballymena, Antrim—Improvements in machinery or apparatus for grinding wheat and other grain.

807. William Brookes, Chancery Lane—Improvements in means or apparatus for obtaining superheated or surcharged steam, and for increasing the draught through the flues of locomotive and other boilers. (Communication from James Martin, Toronto, Canada West.)

808. John Greenwood, Rawden, near Leeds, Yorkshire—Improvements in Machinery or apparatus for combing wool and other fibres.

2nd, 3d, and 4th April, 1861.

809. John G. Winton and Thomas W. Cowan, Bridge Street, Blackfriars—Improvements in the means for actuating machine hammers, which said improvements are also applicable to pile-driving and other such like machines and purposes.

810. John H. Winder, Sheffield, Yorkshire—Improvements in means or apparatus for raising and forcing water and other fluids.

811. Egbert Horlick, Tredegar, Monmouthshire—An improved stand for exhibiting drapery or other goods for sale

812. William A. Lyttle, Arundel Street, Strand—Improvements in and connected with the collars and wrist-bands of shirts.

813. Adolphe Hurray and Hermann Leile, Laffitte Street, Paris—A new optical apparatus for reproducing and varying all sorts of drawings, which apparatus we call "Goniometroscope."

814. Caleb S. Senton, Park Road, Clapham, George Hawkins, and Edward Stansfield, Commercial Road, Peckham, Surrey—An improved trap or flap for covering the entrances of cellars and other places.

815. James Brown, Glasgow, Lanarkshire—Improvements in preparing fabrics to render them suitable for packing goods, and in closing or sealing packages.

816. John Sickels, Gracechurch Street—Improvements in machinery or apparatus for stitching, uniting, and ornamenting leather and other similar materials. (Communication from Elmer Townsend, Boston, U.S.)

817. William Clark, Chancery Lane—Improvements in stamping presses. (Communication from Adolphe C. Guillemot, Paris.)

818. Thomas E. Wilson, Cornholme, near Todmorden, Lancashire—Improvements in machinery for agricultural purposes.

819. William Crighton and Frederick W Crighton, Manchester, Lancashire—Improvements in machinery or apparatus for preparing cotton and other fibrous materials to be spun.

820. Mark H. Blanchard, Blackfriars Road, Surrey—Improvements in the manufacture, construction, and ornamentation of articles made of terra-cotta, stoneware, and plastic clays, adapted for the construction of fire proof stairs, steps, landings, slabs, tiles for roofing and paving, chimney shafts, columns for buildings, posts, or standards, pedestals, and statues, and in the method of moulding the same.

821. Thomas Wright, and Hugh Wright, Dudley, Worcester—A new or improved steam brake.

822. William E Newton, Chancery Lane—Improvements in machinery for cutting and harvesting grain, grass, and other substances—(Communication from William V. Anden, New York, U.S)

823. John Seville, Oldham, and Walter Lawton, Hollinwood, Lancashire—Certain improvements in starting and retarding or stopping railway trains.

824 Adam C. Bamlett, Middleton Tyas, Yorkshire—Improvements in reaping and mowing machines.

825. John G. N Alleyne, Butterly Iron Works, Alfreton, Derbyshire—Improvements in machinery employed in the manufacture of iron.

826. James T. Grice, Birmingham, Warwickshire—An improvement or improvements in ornamenting metallic tubes.

827. Robert Woodruff and Charles Milnes, Red Lion Square, Nottinghamshire—A new or improved construction of carriages for children, commonly called perambulators, to be called "The Nottingham double perambulators."

828. John W. Lee, Crich, Derbyshire—Improvements in apparatus used in winding up watches, clocks, time-pieces, musical boxes, or tell-tales, or for other purposes to which the same may be applicable.

829. Richard A. Brooman, Fleet Street—An improved method of doubling silk threads together, with machinery for effecting the same. (Communication from Beaux, Mahistre, and Rousset, Avignon, France.)

830. William A. Shepard, Pall Mall—Improvements in street railways and wheels, and apparatus to be used therewith.

831. William H. M'Nary, Manchester, Lancashire—Improvements in the mode of and apparatus for knitting.

832. Alfred V. Newton, Chancery Lane—An improved construction of bran duster. (Communication from George Clark, Peter Elting, George Marsh, and Alfred Marsh, Cincinnati, Ohio, U.S.)

833. William E. Newton, Chancery Lane—Improvements in machinery for cutting files. (Communication from William V. Anden, New York, U.S.)

834. Martin Benson, Royal Exchange Buildings—Improvements in generating steam, and in the apparatus employed therein.

835. John S. Miller, and Thomas P. Miller, Dalmarnock, Lanarkshire—Improvements in fixing colouring matters on textile fabrics and fibrous materials.

5th, 6th, and 8th April, 1861.

836 Daniel Stone, Manchester, and Charles Comer, Salford, Lancashire—Improvements in combining metals, and alloys of metals, for the manufacture of coins, checks, vouchers, trade-marks, and other useful articles, and for ornamental purposes.

837. Charles Burn, Delahay Street, Westminster—Improvements in ports and apparatus for opening and closing the port-holes of ships of war, which are also applicable to embrasures of fortifications.

838. William Richardson, New Walk, Leicestershire—Improvements in the axles of carriages and other vehicles used on railroads and on common roads, and also the axles or shafts and other parts of machinery generally, to prevent the breakage thereof occasioned by atmospheric influences.

839. David Brown, Smethwick, Staffordshire, Noah Fellows, Selly Oak, Worcestershire, Edward Jones, Deepfields, and William Brown, Smethwick, Staffordshire—Improvements in the manufacture of nails, railway spikes or pins, and gas tube fastenings, and in machinery employed in the said manufacture.

840. Charles Storer, Richard Jones, and James Storor, Longford, Foleshill, Warwickshire, Improvements in railway brakes.

841. Robert B. Greenwood, Durham Place East, Hackney Road—Improvements in candlesticks and candle-holders.

842. William Edwards, Wolverhampton, Staffordshire—An improvement or improvements in the manufacture of shoes for horses and other beasts of draught and burden, and in the preparation of the metal to be used for this purpose.

843. William E. Newton, Chancery Lane—Improvements in breech-loading fire-arms, (Communication from Christopher M. Spencer, Hartford, Connecticut, U.S.)

844. George Hawksley, Three Mill Lane, Bromley by Bow—Improvements in apparatus for measuring water and other liquids.

845. Adam Stewart, High Street, Croydon—Improvements in capstans.

846. James Dunn, Preston, Lancashire—Improvements in machinery or apparatus for slubbing, roving, spinning, and doubling cotton and other fibrous materials.

847. John Hutson, Richmond, Surrey—Improvements in the manufacture of the posts and joints or connections of bedsteads and other articles of furniture.

848. Jonathan Down, Alderley Edge, Cheshire—Improvements in treating certain ores and alloys, and in obtaining products therefrom

849. William Slater, Bolton-le-Moors, Lancashire—Improvements in machinery for preparing and spinning cotton and other fibrous substances.

850. Richard Wallwork, Bolton-le-Moors, and Thomas Sumner Farnworth, near Bolton-le-Moors, Lancashire—Certain improvements in machinery for preparing cotton and other fibrous substances.

851. Benjamin Knowles, Birmingham, Warwickshire—Improvements in the manufacture of papier maché blank trays.

852. James Knight, Crown Court, Chancery Lane—Improvements in the manufacture of baths and trays and other vessels for photographic purposes, which improvements are also applicable in the manufacture of galvanic battery and other galvanic chambers or cells and other vessels to contain chemical solutions.

853. Thomas G. Ghislin, Hatton Garden, St Andrews, Holborn—Preparing, applying, and adapting certain vegetable productions, called "ciklonia-buccinalis, proteaceæ, tuncus serratus, tuncus trista, and armyllideæ," to further new purposes of manufacture, and certain modes to effect the same.

854. John H. Johnson, Lincoln's-Inn-Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in looms for weaving figured fabrics, and in apparatus connected therewith. (Communication from Samuel T. Thomas, Laconia, U.S.)

855. William Smith, Derby Street, Birmingham, Warwickshire—An improvement in the manufacture of umbrellas, parasols, and other similar articles.

856. William E. Gedge, Wellington Street, Strand—Improvements in the construction of ceilings and partition and other walls. (Communication from Jules M. Dubrot, Metz, Moselle, France).

857. Hyacinthe Deheselle, Thimister, Belgium—A rotatory cone, being a new application of the centrifugal force to the purpose of raising and propelling fluid bodies.

858. Henry Wilde, Manchester—Improvements in electro-magnetic telegraphs, and in apparatus connected therewith.

859. John Clark, Glasgow, Lanarkshire—Improvements in apparatus for feeding or supplying paper or other like material to ruling, embossing, printing, and similar machines, and in certain parts of embossing apparatus.

860 Joseph Walker, and James Barnes, Oakenshaw—An improvement in the manufacture of "card-cloth," used for carding cotton, wool, and other fibrous substances.

861. Andrew Shanks, Robert Street, Adelphi, Westminster—An improved washing machine.

862. Henry W. Blake, Soho, Birmingham, Warwickshire—Improvements in coining machinery, and in apparatus employed for regulating the expansion of elastic fluids.

863. William Clayton, Waterloo Road, Dublin—Improvements in fire-escapes.

864. Richard A. Brooman, Fleet Street—Improvements in apparatus for turning over leaves or sheets of music and other like sheets. (Communication from Louis E. S. Petit, Orleans, France.)

9th, 10th, and 11th April, 1861.

865. George Davies, Serle Street, Lincoln's Inn, and 28 St Enoch Square, Glasgow, Lanarkshire—"Improvements in machinery for dressing and cutting stone. (Communication from Pierre J. Morisseau, Paris.)

866. James Wright, Bridge Street, Blackfriars—An improved method of collecting letters, newspapers, and other mail matters in cities and towns. (Communication from John B. Murray, New York, U.S.)

867. Henry G. Prossor, Waterford—Improvements in the method of and apparatus for preventing the deterioration of grain when deposited in the holds of vessels for shipment, and also in the application of the said method and apparatus to vessels engaged in shipping grain from one port to another.

868. William H. Beddal, Fleet Street—Improvements in apparatus for discharging and distributing the contents of teapots, coffee pots, or other vessels.

869. Charles Gill, Newington, Surrey—Improvements in the construction of swivels, hooks, or other similar connecting instruments for chains, jewellery, and other articles.

870. William H. Phillips, Nunhead, Surrey—Improvements in the combustion of fuel for generating steam, and for other purposes.

871. William Westbury, Aston, near Birmingham, Warwickshire, and Edward Cooke, Smethwick, Staffordshire—A new or improved fastening, which said fastening is applicable to the fastening of windows, and also to the fastening of belts, garters, braces, and other articles of dress.

872. James Higgins, and Thomas S. Whitworth, Salford, Lancashire—Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

873. Abraham Tweedale, John Tweedale, and Samuel Taylor, South Cottage, Healey, near Rochdale, Lancashire—Improvements in temples for looms.

874. William Wood, Birmingham, Warwickshire—Improvements in breech-loading fire-arms and ordnance.

875. William E. Newton, Chancery Lane—Improved apparatus for drawing bolts. (Communication from Hamilton Towle, Cambridge Port, Massachusetts, U.S.)

876. Francis Taylor, Romsey, Southampton—Improvements in apparatus for receiving, drying, and deodorizing human excrement.

877. Frederick Ransome, Ipswich—Improvements in the manufacture of artificial stone and cement or plaster, and in treating timber for the purpose of preserving the same.

878. Thomas A. Weston, Birmingham, Warwickshire—New and improved fastenings, for fastening bands and belts, and articles of dress, and for such other purposes as the same are or may be applicable to.

879. James Ivers and James Pollitt, Preston, Lancashire—A certain improvement in machinery or apparatus employed in preparing cotton, wool, flax, and other fibrous substances for spinning.

880. Andrew Lamb, Southampton, Hants—Improvements in condensers.

881. William B. Peck, Broad Street, Bristol, Somersetshire—Improvements in screw-propellers.

882. Auguste V. Morel, Paris—An improved safety lock.

883. Perry G. Gardiner, New York, U.S.—A new improved spring.

884. John Caw, jun., Halifax, Yorkshire—Improvements in the manufacture of metallic cord, suitable for "crinoline," blind cord, bell pulls, suspending pictures, laces, and for other purposes.

885. William R. Rogers, Gray's Inn Road—Improvements in dowels.

886. Thomas Taylor, Wellington Row, Bethnal Green—Improvements in machinery for the manufacture of chenille and other circular pile fabrics.

887. David Chalmers, Glasgow, Lanarkshire—Improvements in weaving textile fabrics.

888. William M'Connel, Manchester, Lancashire—Improvements in engines for carding cotton and other fibrous materials.

889. James Shand and Samuel Mason, Blackfriars Road, Surrey—Improvements in steam fire-engines and pumps.

890. William Bury, Portman Street, Marylebone—Improvements in steam engines and in boilers for the same.

891. James Lancelott, Brownlow Road, Dalston—Improvements in machinery for the manufacture of sheet-metal chains.

892. Thomas Don, Poultry, Thomas Smith, Tenter Lane, and Loxley Horsfield, Bank Foundry, Leeds—An improvement in machinery and apparatus for drying and preparing grain, seeds, or berries, for food and other purposes.

893. Charles Stevens, Charing Cross—An improved apparatus for raising liquids, especially beer and wine, from casks. (Communication from Ann F. Diewan, Rue Lafitte, Paris.)

894. Charles N, Kernot, West Cowes, Martin D Rucker—Obtaining ammoniacal salts and other valuable products from liquors or substances containing ammonia, and for utilising the residium.

895. Richard A Brooman, Fleet Street—Improvements in sizing or preparing paper and textile fabrics in order to render them waterproof and to increase the strength thereof. (Communication from Leon Bertin and Pierre Carteron, Paris.)

896. Richard Smith, Shaw House, Melksham, Wiltshire—Improvements in roller blind apparatus.

897. William E. Newton, Chancery Lane—Improvements in pressure gauges. (Communication from John Leavens, New York, U S)

898. Samuel Roberts, Hull, Yorkshire—Improvements in steam engines and in generators to be used therewith.

899. John M. Dunlop, Manchester—Improvements in machinery for cleansing cotton.

12th, 13th, and 15th April, 1861.

900. Silas C. Salisbury, Essex Street, Strand, Westminster, and Josiah Turner, Dalston—Improvement applicable to the saving of cop waste.

301. George C. Haseler, Vittoria Street, Birmingham, Warwickshire—Improvements in the joints or hinges of lockets.

902. Thomas Carr, Chowbent, Lancashire—Improvements in machinery or apparatus for forging and shaping articles of iron or other metal or material.

903. Joseph Ward, Blackburn, and Rhodes Greenwood, Whittle-le-Woods, Lancashire—Improvements in machinery or apparatus for preparing fibrous materials to be spun.

904 Joseph Douglas, Blackfriars Road, Surrey—Improvements in kitchen ranges.

905. James E. A Gwynne, Essex Street Wharves, Strand—Improvements in machines for breaking, crushing, and reducing stones and other substances.

906. Joseph C. Rivett, Prestolee New Mills, Farnworth, near Manchester—Certain improvements in machinery for carding cotton and other fibrous materials.

907. Thomas Bailey, Aston Road, Birmingham, Warwickshire — Improvements in breech-loading fire-arms.

908. Joseph R. Cooper, Birmingham, Warwickshire—An improvement in or addition to certain kinds of breech-loading fire arms and ordnance.

909. John Silvester, West Bromwich, Staffordshire—Improvements in spring balances or weighing machines and in dynamometers

910. Albert F. Delannoy, Paris—Improvements in lubricating the axles or journals of wheels, also applicable to lubricating the shafts or axles of machinery in general.

911. George Graham, Dumbartonshire—Improvements relating to ornamental cotton fabrics having Turkey-red grounds.

912. Henry Maden, and James Wheater, Bacup, Lancashire—Certain improvements in machinery or apparatus for spinning cotton, wool, flax, silk, and other fibrous substances.

913. Edgar Corke, South Borough, Tunbridge Wells, Kent—An improved instrument to be fixed on the bayonet or muzzle of a rifle for estimating distances.

914. Charles Roberts, Douglas, Isle of Man—Improvements in boots and shoes and other similar coverings for the feet.

915. Charles D. Abel, Southampton Buildings, Chancery Lane—Improvements in the construction of turntables. (Communication from Jean J. A. Poulet, Paris.)

916. William T. Eley, Gray's Inn Road—Improvements in the manufacture of cartridge cases for breech-loading fire arms.

917. Charles D. Abel, Southampton Buildings, Chancery Lane—Improvements in machinery for forging nails. (Communication from S. Menons, Paris.)

918. James Wright, Bridge Street, Blackfriars—Improvements in the mode of manufacturing and designing postage letter paper, postage envelopes for letters, and postage wrappers or covers for newspapers and other printed matter. (Communication from John B. Murray, New York, U S.)

919. Asa Bradbury, Oldham, Lancashire—Improvements in machinery for spinning and doubling cotton and other fibrous materials.

920. Andrew Shanks, Robert Street, Adelphi, Westminster—Improvements in machines for drilling and boring metals.

921. Edgar Brooks, Birmingham, Warwickshire—New or improved machinery for grinding and polishing swords, matchetts, and knives, which said machinery may also be employed for grinding gun barrels and files, and for other like purposes.

922. James Smith, and Sydney A. Chease, Seaforth, Liverpool, Lancashire—Improved arrangement of engine for obtaining and applying motive power.

923. Alphonse Sax, Paris—Improvements in ordnance and projectiles.

924. Thomas Miller, Fossaway, Perthshire—Improvements in the method of, and machinery for, preparing india-rubber and other similar gums for insulating telegraphic wires, and in machinery for laying or applying strips of India-rubber and other similar gums or strips of fibrous or textile material on to telegraphic wires.

925. Robert C. Furley, Edinburgh, Mid-Lothian—Rendering pills tasteless by means of a coating of albumen.

926. Frederick Lennard, Belgrave Gate, Leicestershire—Improvements in the manufacture of looped pile fabrics.

927. Frederick Gye, Wandsworth Road, Surrey—Improvements in obtaining light, and the apparatus employed therein.

16th, 17th, and 18th April, 1861.

928. Samuel Ridge, Hoviley Bridge, near Hyde, Chestershire—Improvements in apparatus applicable to steam boilers and steam engines

929. Frederick M. Eden, Hare Court, Temple—An improved method of manufacturing silicate of lime or hydraulic cement.

930. Frederick M. Eden, Hare Court, Temple—An improved cartridge for breech-loading guns.

931. Pierre Gipouloux, Rue Thevenot, Paris—An improved cooking stove.

932. James D Malcolm, Brixton, Surrey—Improvements in the manufacture of nitric acid and caustic soda, which are also applicable to the obtaining of other chemical products.

933. Robert Ransome, Ipswich, Suffolk—Improvements in inkstands.

934. Charles Fletcher, Nottingham—Improved machinery or apparatus for the manufacture of chenille.

935. Robert Hodgson, and Enoch Holden, Carlisle, Cumberland—Improvements in the manufacture of soap.

936. David Chalmers, Glasgow, Lanarkshire—Improvements in looms for weaving.

937. William Jenkins, Montpelier Street, Brompton—Improvements in medicated belts or bands for the alleviation of pain in or prevention of cholera, and for the prevention or cure of pulmonary or other complaints.

938. Thomas Jones, Bolton-le-Moors, and George Mallinson, Salford, Lancashire—Certain improvements in the manufacture of piled fabrics

939. John R Hill, Duke Street, Adelphi—Improvements in clutches or connections for machinery.

940 Henry Anthonissen, Brussels, Belgium—A new system of panification and simultaneous extraction of starch.

941. Joseph Vickerman, Taylor Hill, near Huddersfield, Yorkshire—Improvements in syphons for carrying off the condensed water from steam pipes

942. Gustave Leroy, Bristol—An improved construction of vessel for containing aerated liquids. (Communication from Auguste Savareze, Paris.)

943. William A. Dixon, Newport, Monmouth—Plastering walls and ceilings.

944 Benjamin Brown, and Richard Hacking, Bury, Lancashire—Certain improvements in machinery or apparatus employed in spinning cotton, wool, silk, and other fibrous substances.

945. William Clark, Chancery Lane—An improved arrangement of atmospheric post for the transmission of letters patent and other despatches and articles in tubes. (Communication from Francois A. Kieffer, Paris.)

946 Henry A. F. Duckham, Clerkenwell—Improvements in gas meters and regulators, and in compounding materials to be used as a coating for, or in the composition of, substances subject to the action of gas.

947. Charles Norton, Hanley Street, Birmingham, Warwickshire—Improvements in the manufacture of ornamental eyelets.

948. Hugo Carstanjen, Cologne—Improvements in the apparatus for, and method of, increasing the illuminating power of gas.

949. Charles Stevens, Charing Cross—Improved bands for transmitting motion to machinery. (Communication from Jean J. Thiberge, Rue Laffitte, Paris.)

950. Henry Jones, Birmingham, Warwickshire—Improvements in certain kinds of breech-loading fire-arms

951. Thomas B. Wilkinson, Deptford, Kent—An improved means for securing a watch in the pocket of the wearer.

952. Edward Morgan, Liverpool, Lancashire—Improvement in ships' and other pumps.

953. Benjamin Brown, and Richard Hacking, Bury, Lancashire—Certain improvements in machinery or apparatus to be employed in preparing cotton and other fibrous materials for spinning, called "roving frames" and "slubbing frames"

954 James Byson, Worcester Street, Birmingham, Warwickshire—Improvements in weighing machines.

955. Richard A Brooman, Fleet Street—Improvements in producing photographic pictures. (Communication from Adolphe Fargier and Nicholas Charavet, France.)

956. Alfred V Newton, Chancery Lane—Improvements in machinery or apparatus for cleaning cotton and other fibrous substances. (Communication from Isaac Hayden, Lawrence, Massachusetts, U S.)

957. Charles Jordan, Newport, Monmouth—Improvements in apparatus for drying the moulds and cores used for iron or other castings.

958. Mary Buchanan, Glasgow, Lanarkshire—Improvements in gloves.

959. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in electric telegraph apparatus. (Communication from Marco Maroui, Turin, Sardinia.)

960. William Benson, Hexham, Northumberland—Improvements in the construction of furnaces for the better combustion of fuel and the prevention of smoke.

19th, 20th, and 22d April, 1861.

961. Arthur F. Eaves, Birmingham, Warwickshire—An improvement or improvements in the manufacture of the bezels or rings used in glazing the dials of clocks, barometers, and steam gauges, and for other like purposes.

962. Philippe Mingaud, Rue Laffitte, Paris—New alimentary and chemical products, drinks obtained by specially treating the fruits of a tree called Arbousier.

963. James Makinson Brierley, Manchester, Lancashire—Improvements in the manufacture of woven fabrics, applicable to crinoline skirts and petticoats, or other similar articles.

964. Isaac Riley and Thomas Carns, Wolstenholme, Blackburn, Lancashire—Improvements in heating apparatus for domestic and other purposes.

965. Robert M'Laren, Glasgow, Lanarkshire—Improvements in jointing or connecting pipes.

966. John Ridley, Stagshaw, Northumberland—Improvements in steam generators and super-heaters.

967. John Ridley, Stagshaw, Northumberland—Improvements in cutting apparatuses for reaping and mowing machines.

968. John Ridley, Stagshaw, Northumberland—An improved portable cinder sifting apparatus.

969. William Grove, Shoe Lane—Improvements in or connected with cylinder printing machines.

970 Frederick J. Jones, Aldermanbury—An improvement in braces.

971. John P. Shenckl, Boston, Massachusetts, U.S.—A new and useful packing for projectiles for guns or ordinance, especially those which are rifled or grooved on their bores.

972. John Jobson, Derby—Certain improvements in apparatus to be employed in connection with cornish and other similar boilers for the purpose of consuming the smoke.

973. William Hudson, and Christopher Catlow, Burnley, Lancashire—Improvements in looms for weaving.

974 Henry Parkes, Birmingham, Warwicksbire—Improvements in producing ornamental surfaces of metal and other materials.

975. John Gjers, Middlesborough-on-Tees, Yorkshire—Improvements in the construction of machinery or apparatus for obtaining motive power.

976 William Ryder, and Thomas Ryder, Bolton-le Moors, Lancashire—Improvements in machines for fluting rollers and for shaping metals

977. Matthew Smith, Birmingham, Warwickshire—Improvements in annealing pots or pans.

978. John Whitehouse, Birmingham, Warwickshire—Improvements in the manufacture of door and other knobs, and the ornaments of the pillars of metallic bedsteads and other articles of like manufacture.

979. James Pinchbeck, Whiskin Street, Clerkenwell—Improvements in wet gas meters.

980. Richard A. Brooman, Fleet Street—Improvements in mills for grinding corn and other grain. (Communication from Joseph Perrigault, Rennes, France.)

981. Jean B. J. Noirot, Boulevart St Martin, Paris—An improved process for manufacturing india-rubber pipes.

982. William Clark, Chancery Lane—Improvements in ornamenting porcelain and other earthenwares and glass. (Communication from Samuel Daniels, Paris.)

983. James Webster, Birmingham, Warwickshire—Improvements in manufacturing oxygen gas, and obtaining certain other products.

984. Samuel B. Haskard, Wollaton Street, John Dean, and Edward Dean, Radford, Nottinghamshire—Improvements in machinery for the manufacture of looped fabrics.

985. James Waddell, Hill Street, Knightsbridge—Improvements in drums.

986. Aaron Smith, Ledgley, Staffordshire—Improvements in apparatus for ventilating forges and other overheated workshops.

987. George A. Huddart and Joseph D. E. Huddart, Brynkir, Carnarvonshire—Improvements in steam and other engines.

988. Alfred V. Newton, Chancery Lane—An improved mode of bleaching and refining oils and other fatty substances. (Communication from Ferdinand Feist, New York, U.S)

989. Alfred V. Newton, Chancery Lane—Improvements in the construction of liquid meters. (Communication from Gottfried Kober, New York, U.S.)

990. James Leetch, Margaret Street—Improvements in the manufacture of breech-loading fire-arms, and a new method of attaching the barrel or barrels of a gun to the stock.

991. Henry Moore and Abraham Higgin, Burnley, Lancashire—Improvements in machinery or apparatus for spinning and doubling cotton, wool, flax, and other fibrous materials.

992 Thomas Parry, Plymouth, Devonshire—Improvements in the manufacture of cartridges.

993. Edward D. Bourne, and Paul Davis, Birmingham, Warwickshire—Improvements in certain kinds of cornice poles and curtain rods, and in the runners used in cornice poles and curtain rods, and in the manufacture of tubing to be made into the said cornice poles and curtain rods.

994. Anthony Dugdale, Paris—Improvements in centrifugal governors for steam engines.

995. Hypolite Tarbouriech, Laffitte Street, Paris—A double system mixed press.

996. George W. Belding, Moor Lane, Cripplegate—Improvements in sewing machines. (Communication from William S. Thomson, Broadway, New York, U.S)

997. George W. Belding, Moor Lane, Cripplegate—Improvements in machines for making pointed tape trimming. (Communication from William S. Thomson, Broadway, New York, U.S.)

998. John T. Dowling, Frampton Park Road, Hackney—An improved instrument applicable to time keepers for presenting to view numerals to indicate time.

999. Charles Carey, Kennington Green, Surrey—Improvements in the apparatus used in making infusions of coffee and other substances.

1000 Alexander Henry, Edinburgh, Mid-Lothian—Improvements in fire-arms, and in apparatus to be used therewith.

23rd, 24th, and 25th April, 1861.

1001. Richard Shaw, Patricroft, near Manchester, and William Snodgrass, Portlaw, Waterford—Certain improvements in machinery for spinning cotton and other fibrous materials.

1002. Thomas Y. Hall, Newcastle-upon Tyne—Improvements in safety lamps, and in domestic grates, stoves, and furnaces.

1003. William Clark, Chancery Lane—Improvements in looms for weaving stays or corsets and other similar articles. (Communication from Alexis Manigot, Paris)

1004. Thomas Peters, Great Alie Street, Whitechapel—Machinery or apparatus for moving, conveying, transporting, or transmitting bodies.

1005. Joseph D. Samuda, Poplar—Improvements in the construction of iron vessels of war.

1006. Peter Ward, Cloud Hill Villas, Bristol—Improvements in the manufacture of sulphuric acid.

1007. John Marshall, Richard Street, Liverpool Road, Islington—Improvements in apparatus used for retarding and stopping railway carriages, and in the construction of railway axles.

1008. Thomas Richardson, Newcastle-on-Tyne—Improvements in the purification of coal gas.

1009 Edward H. Bentall, Heybridge, near Maldon, Essex—Improvements in constructing the framing of various kinds of agricultural implements.

1010. Edward H Bentall, Heybridge, near Maldon, Essex—Improved machinery for cutting or pulping roots to be used as food for cattle.

1011. Robert Warry, Chatham, Kent—Improvements in the construction of breech-loading ordnance, and in the carriages and projectiles used for the same,

1012. Michael Henry, Fleet Street—Improvements in aerated liquid apparatus. (Communication from Jean A. Bazet, Boulevart Saint Martin, Paris)

1013. Michael Henry, Fleet Street—Improvements in telegraphic apparatus. (Communication from Ernest G B. Guillier, Boulevart Saint Martin, Paris.)

1014. Alfred Leighton, Buckingham Street, Strand—A spring to be called the honey comb spring.

1015. Sampson Handley, Cancel Street, Walworth. Surrey—Improved apparatus for receiving and consuming the residues of candles or other fatty or oleaginous substances.

1016. Ebenezer Woodcock, Forest Hill, Surrey—Improvements in treating flax, hemp, rhea, China grass, New Zealand flax, plaintain, and other vegetable fibres and in the means or apparatus employed therein. (Communication from George Rutter, Boulogne-sur-mer, France)

1017. Frederick J. Bramwell, Great George Street, Westminster—Improvements in machinery for spinning fibrous materials.

1018. Emile Lecot, Cecil Street, Strand—An improved nose bag or horses. (Communication from Mme. Vve de Favre, Paris.)

1019. Charles Stevens, Charing Cross—A new artificial manure. (Communication from Hypolite L. M. Planchais, Rue Laffitte, Paris)

1020. George D. Davis, Bromley Terrace, St Leonard's Road, and Joseph Davis, Archer Terrace, East India Road—Improvements in machinery for raising anchors, stopping cables, preventing cables from riding, and other like purposes.

1021. William Lord and Joseph Hilton, Royton, near Oldham, Lancashire—Improvements in self-acting mules.

1022. Joseph Rhodes, and Richard Kemp, Morley, near Leeds, Yorkshire—Improvements in rag machines.

1023. Frederic N. Gisborne, Adelaide Place, London Bridge—Improvements in the construction of electric targets for rifle and gun practice.

1024. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in separating or extracting silver from lead. (Communication from Jules F. de la Batie, and Clement Roswag, Paris)

1025. William Wilson, Newcastle-upon-Tyne—Improvements in the manufacture of hats.

1026. Daniel Stone, Manchester, Lancashire—Improvements in arrangements or apparatus for preventing water pipes from bursting by the action of frost.

1027. Edward H. Bentall, Heybridge, near Maldon, Essex—Improved apparatus for transmitting motion to machinery to be driven by horse power.

1028. Thomas Greenwood. Leeds, Yorkshire—Improvements in the construction and working of saw frames.

1029. George Scott, Isle of Dogs—Improvements in steam engines and their apparatus for generating steam.

1030 Thomas Taylor, Wellington Row, Bethnal Green—Improvements in machinery for cutting certain fabrics into strips.

1031. Delabere Barker, Clapham, Surrey—Improvements in signalling and in apparatus connected therewith, adapted to communicating from the land to vessels at sea, and also applicable to other purposes. (Communication from Thomas T. V. Smith, St John, N B., British North America.)

1032. George Bartholomew and William Bisset, Hoxton Square—Improvements in portable fountains.

1033. Pierre C. Lefol, South Street, Finsbury—Improvements in the manufacture of iron wheels.

1034. Charles Callebaut, South Street, Finsbury—Improvements in sewing machines.

1035. William Harris, Villa Street, Walworth, Surrey—Improvements in treating hides and skins to render them suitable to be made into straps for driving machinery, and to be used for other purposes for which leather is commonly employed.

1036. Perry G. Gardiner, New York, U.S.—Improvements in the construction of springs.

1037. Thomas Garner, Moorside, Worsely, Lancashire—Improvements in machinery or apparatus for preparing and spinning cotton, wool, flax, silk, and other fibrous materials.

1038. Robert Gray, Sheffield, Yorkshire—Improvements in the mode of hardening and tempering crinoline flattened wire or sheet steel. (Communication from J. W. Goodwin, Brooklyn, New York.)

1039. Samuel Fox, Deepcar, near Sheffield, Yorkshire—Improvements in hardening and tempering steel.

1040. Edward Strangman, Waterford—An improved method of intercepting and carrying off the sewage of large towns, and preventing the defilement of rivers thereby.

1041. John S Templeton, Glasgow, Lanarkshire—Improvements in looms for weaving pile fabrics, such as "fur-warp," or "improved patent Axminster" carpeting, and in weaving the same.

1042. Hesketh Hughes, Homerton, and Charles G Hill, Nottinghamshire—Improvements in the manufacture of rollers for printing, embossing, and otherwise producing designs, patterns, figures, and shapes.

1043. Thomas Moore, Regent Circus, Piccadilly—Improvements in windlasses worked by capstans, also in the means of stopping or checking the chains in connection therewith.

1044 Alfred V. Newton, Chancery Lane—Improved apparatus for regulating the water level in steam boilers. (Communication from George W. Rains, Newbury, Orange, New York, U.S)

1045. Silas C. Salisbury, Essex Street, Strand, Westminster, and James Starley, Lewisham, Kent—An improved combination sewing machine.

26th, 27th, and 29th April, 1861.

1046. John Lunn, George Hilly, and John Lisle, Huddersfield Yorkshire—Improvements in means or apparatus for stretching fabrics during the processes of finishing fabrics.

1047. Charles J. Hill, Coventry, Warwickshire—Improvements in the dials of watches and clocks.

1048. Richard J. Cole, Pembridge Gardens, Bayswater—Improvements in ornamenting the backs of brushes.

1049. Edward Newby, Camomile Street, Bishopgate Street Within—An improved connecting link.

1050. John H. Brown, Romsey, Hants—Improvements in apparatus for lubricating the barrels of fire arms and ordnance.

1051. Ferdinand C. Warlich, London Street, Fenchurch Street—Improvements in preparing coal used in the manufacture of artificial fuel.

1052. William Cowan, Edinburgh, Mid-Lothian—Improvements in gas meters.

1053. Edward Strangman, Waterford—An improved system of building or construction applicable to architectural and other similar purposes.

1054. William Griffith, Upper Sydenham, Kent—Improvements in hooped petticoats or crinolines.

1055. John Marshall, Liverpool Road—Improvements in preventing the fracture of metals from crystallization.

1056. James Dellagana, Shoe Lane—Improvements in apparatus for embossing and taking casts or matrices for stereotype and other purposes.

1057. Edmund H Joynson, St Mary's Cray, Kent—Improvements in machinery for the manufacture of paper

1058 John Watkins, Birmingham, Warwickshire—Improvements in carriage axles and axle boxes.

1059. Silas C. Salisbury, Essex Street, Strand Westminster, and James Starley, Lewisham, Kent—Improvements in sewing machinery.

1060. John Poole, Bridge Street, Blackfriars, and William Milward, Camberwell, Surrey—Improvements in the construction of hoops or tyres for wheels to be used on railways and tramways.

1061. John Foster, Radford, Edward H. Bramley, and Edwin Knutton, Nottingham—Improvements in the manufacture of twist lace, and in machinery employed therein.

1062. Thomas V. Morgan, and Julius G. Dahlke, Battersea, Surrey—Certain improved filtering agents, one of which is applicable in the manufacture of crucibles.

1063 Jabez B. Farrar and Joshua Farrar, Halifax, Yorkshire—Improvements in machinery or apparatus for spinning wool, cotton, silk, or other fibrous substances.

1064. Thomas W. Miller, Portsmouth—Improvements in steam engines and apparatus connected therewith.

1065. George G. Ray, Boston, Massachusetts, U.S—An improved pen holder.

1066. William H. Parsons, Cambridge Heath Road—Improvements in machinery for making nuts, bolts, and rivets.

1067. George M. Story, Coleman Street, and George W. Edwards, Mintern Street, Hoxton—Improvements in billiard tables.

1068. Henry T. Wedlake, Warren Street, Tottenham Court Road—Improvements in harmoniums.

1069. Henry Bessemer, Queen Street Place, New Cannon Street—Improvements in projectiles and ordnance.

1070. William E. Newton, Chancery Lane—An improvement in gas burners. (Communication from William Benjamin, New York, U.S)

1071. James Mash, Manchester, Lancashire—Improvements in steam engines.

1072 Francois A Thonier, Bourbon l'Archambault, Allier, France—A reaping machine called "Thonier's reaping machine."

1073 Jean B. H. Desplas, Harfleur, Seine-Inferieure, France—A so-called hypocampaphile or elastic apparatus, whereby the legs of running horses are protected from accidents.

1074. Henry Dixon, Park Street, Sydenham, Kent—Improvements in photography.

1075. William Johnson, Little Malvern, Worcestershire—Improvements in saddle trees.

1076. William E. Newton, Chancery Lane—Improvements in desiccating and torrefying farinaceous and other substances. (Communication from Francis Huckins, Roxbury, Norfolk, Massachusetts, U S.)

30th April, and 1st and 2d May, 1861.

1077. Henri J. T. Labat, Boulevart St Martin, Paris—An improved apparatus for hauling ashore ships and vessels of all sizes and descriptions.

1078. George Hulme, Rochdale, Lancashire—An improvement or improvements in the process of carding wool, cotton, silk, or other fibrous materials, and in machinery or apparatus applicable for that purpose.

1079. Jacques Meyer, Manchester, Lancashire—Certain new chemical combinations, and for the application thereof to fixing aniline and pigment colours in printing and dyeing, to tanning, waterproofing, and other industrial purposes. (Communication from Dr Francis L. Sonnenschein, Berlin)

1080. Thomas A. Kendal, Cowley Street, St George's in the East, and Martin D Rogers, Bow Lane Cottages, St Leonard's Road, Bromley—An improved chain cable controller for ships' windlasses to prevent riding of cable in paying out and heaving in of same.

1081. William Horn, Butler's Terrace, Ossory Road, Old Kent Road, Surrey—Improvements in steam and water tight joints for fixing tubes in plates, such as are used for surface condensers, distillers' refrigerators, vessels for heating feed water or tubular boilers. (Communication from Horatio Allen, New York, America.)

1082. Isaac Hollis, Birmingham, Warwickshire—An improvement or improvements in the manufacture of the guards and trigger plates of rifles and other small arms.

1083. John Sickels, Gracechurch Street—Improvements in sewing machines. (Communication from W. Cleaveland Hicks, Boston, U S.)

1084. Robert Laing, Ince, Wigan, Lancashire, and Israel Swindells Wigan—Improvements in the treatment of certain ores containing metals, and in obtaining products therefrom.

1085. Frederick J. Bramwell, Great George Street, Westminster, and William Owen, Phœnix Iron Works, Rotherham—Improvements in the manufacture of rails, bars, plates, cylinders, vessels, axletrees, cranks, wheel tyres, and other articles of wrought iron or steel, and also in the machinery used in such manufactures

1086 Arthur E. Holmes, Derbyshire—Improvements in landaus, sociables, and other like headed carriages.

1087 Francois Z. Roussin, Boulevart St Martin, Paris—Colouring matters derived from napthylamina dinitronapthalina, and trinitronapthalina, and application of such colouring matters to the dyeing and printing of fabrics

1088. William Browning, St John Street, West Smithfield—A new method and apparatus for ascertaining the distance of distant objects.

1089. Thomas Hooman and John Maliszewski, New Oxford Street—Improvements in photographic printing upon the interior of any glass or other transparent vessel

1090. Johann E. F. Ludeke, Marke, Hanover—Improvements in motive power engines.

1091. Alexander McNeile, Liverpool, Lancashire—Improvements in the construction of targets.

1092. Robert T. Pattison, Daldorch House, Ayrshire—Improvement in the means and method of fixing colours in connection with the printing and dyeing of woven fabrics and yarns.

1093. William Walton, Ivy Cottage, Old Charlton, Kent—A new manufacture of overlapping wall facing.

1094. John C. Wilson, Bucklersbury—Improvements in centrifugal machines.

1095. John C. Wilson, Bucklersbury—Improvements in machinery or apparatus for the manufacture of sugar.

1096. William Scholes, High Town, Leeds, Yorkshire—Improvements in carding engines for carding wool, cotton, silk, or other fibrous substances.

1097. William Hoyle, Greenhill Terrace, Greenhill, Oldham, Lancashire—Certain improvements in machinery for preparing, spinning, and doubling cotton and other fibrous substances.

1098. Michael Winkler, Gumpendorf, Vienna—Certain improvements in locks and other fastenings.

1099. Eugene de Bassana, and Adolphe Brudenn, Brussels—Improvements in the manufacture of stearine.

1100 Lewis J. Jordan, Bedford Square—An aphrodision phosphorized nervine tonic

1101. William Clark, Chancery Lane—Improvements in the imitation of gold and silver embroidery. (Communication from Jean J. G M. Arthaud, Paris)

1102. Laurent Glalard, Roane, France—Improvements in horse draughts and carriage fittings, allowing to take all at once horses from carriages when running away, and to lock the wheels of the said carriages.

1103. Richard A. Brooman, Fleet Street—Improvements in solar time-keepers or chronometers. (Communication from Paul Flechet, Paris.)

1104. George Davies, St Enoch Square, Glasgow, Lanarkshire—Improvements in gas burners. (Communication from Hubert Bosch, Maestricht, Netherlands.)

1105. Joseph G. Brown, Croxton, Leicester—Improvements in obtaining motive power

1106. Peter Wright, Dudley, Worcestershire—Improvements in the manufacture of wheels, and in apparatus or machinery to be employed therein.

1107. William Clissold, Dudbridge, Gloucestershire—An improved construction of driving belt.

1108. George Mead, Bethnal Green Road—An improved portable canteen adapted for use in the army, and for volunteers, tourists, and others.

3d, 4th, and 6th May, 1861.

1109. Marc A. F. Mennons, Rue de l'Echiquier, Paris—The manufacture of paper and card-board from a fibrous vegetable matter not hitherto used for that purpose. (Communication from Edmond Nuewens, Montreuil-sons-Bois, France.)

1110. Alexander F. Rhind, Norfolk Place, Lower Road, Islington—Improvements in the fastenings of brooches, pins, and other articles of jewellery, which fastenings are also applicable to other articles.

1111. Thomas Bradshaw, Salford, Lancashire—Certain improvements in machinery or apparatus for doubling yarn or thread

1112 George Hayes, Elton, Huntingdon—Improved apparatus for applying motive power.

1113. Owen Rowland, Wellington Road, Kentish Town—Improvements in electric telegraphs.

1114. Peter A. Godefroy, King's Mead Cottages, New North Road, Islington—Improvement in the manufacture of gutta percha

1115. James A. Manning, of the Inner Temple—A mode or method of collecting ammonia from the waste gases arising from the combustion of coal.

1116. Alexander Wight, Friday Street, Cheapside—Improvements in the manufacture of trimmings (Communication from James Wilson, New York, U.S., and Hector Tyndale, Philadelphia, U.S.)

1117 William E Newton, Chancery Lane—Improvements in the treatment of copper ores. (Communication from Joseph M. Pinsienne, Paris.)

1118. Edward Humphreys, Deptford, Kent—Improvements in machinory or steam vessels

1119. Joseph Johnson, Leader Street, Chelsea—Improved show or window boards or tablets to be used for advertising and other purposes.

1120. William Addy, Pigot Street, Manchester—Improvements in machinery for washing fabrics and for churning

1121. George Rydill, Dewsbury, Yorkshire—A smoke consumer and condenser suitable for factories, railway engines, steam ships, furnaces, brick kilns, cinder ovens, bakehouses, and other purposes.

1122. George W Reynolds, Birmingham, Warwickshire, and Samuel G Taylor, Oldbury, Worcestershire—A new or improved hand drill for drilling wood, metal, and other materials. (Communication from William Kimberley, New York, U.S.)

1123. William Rowan, Belfast, Antrim—Improvements in machinery or scutching flax and other fibrous substances, applicable also for reducing flax, hemp, and other fibrous materials into tow.

1124 Richard A Brooman, Fleet Street—An improved thread for weaving and other usea (Communication from Charles Lewandosi, Paris)

1125. William C. Homersham, Adelphi Terrace—Improvements in engines and implements for ploughing and cultivating land, parts of which improvements are also applicable to other purposes.

1126. William Palmer, Evelyn Place, Brighton, Sussex—Improvements in apparatus for facilitating the imbibing of liquids.

1127. John M. Baab and Frederick O. Thomas, Gerrard Street, Soho—Improvements in apparatus for perforating paper, parchment, and other substances.

1128. Edward P. Smith, Weymouth, Dorsetshire—Improvements in the construction of radial traversing carriages.

1129. Edward B. Wilson, Great Ryder Street, St James', and William Fijon Newland Street, Eaton Square—Improvements in the manufacture of railway wheels, tires, and other annular, cylindrical, and hollow articles from cast steel or malleable cast iron, and in the machinery or apparatus employed therein.

1130. William Birks, Sen, William Birks, Jun., and John Birks, Nottingbam—Improvements in the manufacture of lace or net, and in the machinery employed therein.

1131. Joseph V. Vignon, Dean Street, Soho Square—A mode of preparing or making enamel applicable to various purposes.

1132. George Ager, Aylsham, Norfolk—Improvements in means or apparatus for breaking or opening land.

1133. Joseph C. Tiffany, New York, U S—A mode of promoting a more perfect combustion of fuel in furnaces, and the manner of effecting the same.

1134. Thomas Blackburn and Mark Knowles, Blackburn, Lancashire—Improvements in machinery or apparatus for warping cotton, worsted, and other similar materials, and in expanding combs used in connection therewith, and also in springs used in the manufacture of the said combs, which springs are applicable to other purposes.

1135. Edward T. Hughes, Chancery Lane—Improvements in the manufacture of artificial flowers and similar articles. (Communication from Edward Delcambre, Paris.)

1136. Edward L. Paraire, Rathbone Place—Propelling carriages on the common roads.

1137. William Abbott, Richmond, Surrey—Improvements in the construction of cages for singing and other birds or animals

1138. William Johnson, Little Malvern, Worcestershire—Improvements in railway carriages and locomotive engines.

1139. William Johnson, Little Malvern, Worcestershire—Improvements in apparatus for churning and kneading.

1140. George H. Ellis, New Malton, Yorkshire—Improvements in apparatus for cleaning boots and shoes, which are also applicable for cleaning knives, forks, plate, and other articles.

1141. Richard A Brooman, Fleet Street—The manufacture of threads, cords, fabrics, felt, and pulp from the hop plant. (Communication from Barthelemy Picard, Nancy, France.)

1142. John Drew, Hatton Garden—Improved apparatuses to be employed for supporting structures while inserting girders therein.

1143. George Coles, James A. Jaques, John A. Tanshawe, and Thomas Galpin, Totenham—Improvements in the manufacture of various articles of wearing apparel.

1144. William E. Newton, Chancery Lane—An improved lubricating compound. (Communication from John B. M'Munn, Orange, New York, U.S.)

1145. Joseph Burch, Cragg Hall, near Macclesfield, Chestershire—Improvements in the construction of steam and other boilers, and apparatus connected therewith.

7th and 8th May, 1861.

1146. Charles Stevens Charing Cross—Improvements in gutta percha and India rubber toys. (Communication from Henry Gallante, Rue Laffitte, Paris)

1147. Hermann Hirsch, Bridge Road, Lambeth, Surrey—Improvements in obtaining and applying electricity for telegraphic and other purposes.

1148 Sidney A. Beers, Brooklyn, New York, U.S.—Improvements in rails for street railroads.

1149. Jean B. Jarlat, South Street, Finsbury—Certain improvements in machinery for the manufacture of artificial fuel.

1150. William E Newton, Chancery Lane—Improved apparatus for boiling substances and generating steam. (Communication from Daniel Prindle, East Bethany, Genesee, New York, U.S.)

1151. Francois Defaye, Capian, near Bordeaux, France—Improved hydraulic apparatus.

1152 William E Gedge, Wellington Street, Strand—Improved means and apparatus for conducting or forcing the flow of water. (Communication from Charles Douchum, Saint Cloud, near Paris.)

1153. James Willis, Little Britain—Improvements in umbrellas and parasols.

1154. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarshire—An improvement or improvements in buttons for garments or other purposes. (Communication from George Meacham, New York, U.S.)

1155. George Daives, St Enoch Square, Glasgow, Lanarkshire—Improved apparatus for boiling sugar. (Communication from Hector Lavignac, Paris)

1156. William Birks, sen., William Birks, and John Birgs, Nottingham Improvements in the manufacture of bobbin net or lace.

1157. Joseph Pickett, Chiswell Street, Finsbury—Improvements in covering or partially covering the sticks and handles of whips and parasols, as also various other articles, with flock, and producing ornamental effects thereon.

1158. Thomas Blackburn and Mark Knowles, Blackburn, Lancashire—Improvements in looms for weaving.

1159. Thomas Elce, jun., Manchester—Certain improvements in machinery for combing wool, cotton, and other fibres

1160. Jean Nadal, Brooke's Market, Brooke Street, Holborn—Improved candlesticks.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from February 13, *to March* 27, 1860.

Feby. 13, 4336 Edward James, Starch and Rice mills, Plymouth—"Blocks of black-lead."
" 19, 4337 Hartshorne & Ward, Queen's Cross Dudley—"Rolled metal for heels or tips for boots and shoes"
" 21, 4338 Stephen William Silver & Co., 65 and 67 Cornhill and 3, 4, 5, and 6 Bishopgate Street Within, E.C.—"The Foresight Protector."
" 22, 4339 John Lingard, Wharncliff Side, near Sheffield—"The Cavour knife sharpener"
" 27, 4340 John Henry Glew, 19 Howland Street, Fitzroy Square, W.—"The new side fastening boot."
March 1, 4341 Charles Warburton, 63 Broad Lane, Sheffield—"Auger nose"
" 1, 4342 Joseph Nicholas, jun., Cheapside, Birmingham—"An improved riddle or sieve."
" 1, 4343 Farrow & Jackson, 18 Great Tower Street E.C.—"Bottle rack."
" 4, 4344 Edward Brimble, 16 Old Change, E.C.—"The hygieme corset"
" 4, 4345 The Yorkshire Bottle Company, Victoria Wharf, Earl Street, Blackfriars, S.—"Stopper for bottles or jars."
" 9, 4346 John Frederick Simmonds, 7 Melton Street, Euston Square, N.W. "Draught screen for doors"
" 12, 4347 Albert Lewis Wool, Birmingham—"Miniature or device brooch"
" 26, 4348 Christian Weintraud, jun, Offenbach-on-the-Maine—"Improved frame and fastening for purses and other similar articles."
" 27, 4349 George Wilson, York—"Plug for glass taps."

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

IV.

Certainly the great question of the day, the supply of cotton to our manufacturing districts, is assuming proportions of a very alarming character; and it happens in this instance, as in so many others, that the first object of inquiry strikes the key-note of many collateral ones. Thus, in the recent debates upon the prospects of securing a supply of any great amount of cotton from India, one of the speakers called the attention of the public to the present state of the tenure of landed property in that country, and to the serious impediment it offered to the importation of English capital and enterprise into that colossal dependence of the Crown. It always has been the policy of Oriental Governments to retain in their own hands the possession of the land submitted to their rule; and the late East India Company, acting upon the same traditions, had consistently opposed the creation of a class of landed proprietors, holding, as we should say, "in fee simple." Yet it is only on the condition of the inalienability of the possession that a prudent man would invest large sums in the introduction of a new system of agriculture. Nor can the rulers of India hope to witness the establishment of a permanent English colony, unless they allow the colonists to enjoy all the results of their labour and enterprise. Possibly our Government may not desire to see such colonies established; but it is, we think, very unlikely that any great progress can be made in the extension of the cotton cultivation, unless it be conducted under European superintendence, and by means of European capital; so that the first step to be taken to secure the desired end must be directed towards favouring the means. At any rate, it behoves the English public, before it counts upon assistance from India, in its present strait, to inquire seriously into the social organization of the country it looks to; for it is much to be suspected that there are causes at work, with respect to the tenure of land, which will long oppose the development of its boundless resources. The same causes must also operate, in some way or other, to interfere with the prosperity of the great railway, canal, and irrigation works lately undertaken in that country, because so long as the tenure of land remains in as unsatisfactory a state as it now does in the greater portion of that peninsular, so long must the population and the prosperity of the country suffer. Whilst the English are moving the ends of the earth for objects of our zeal and charity, this obvious question of the social condition of our immense dependency has escaped the notice of our philanthropists and of our statesmen. Let us hope that the want of cotton may at last rouse the nation from its apathy in a case wherein they ought to feel a grave responsibility.

Having casually alluded to the question of irrigation as applied to our Indian possessions, it may be worth while here to dwell more at length on it, because, in the first place, the Indian irrigation companies have attracted a great deal of attention from our capitalists, and other projects of the same nature for the South African and the Australian colonies have been recently propounded; and, in the second place, because Sir C. Wood has expressed in the House of Commons some opinions with respect to the political economy of public works, against which it is advisable to protest as soon as possible. After stating that the Madras Irrigation Company had failed, because the works upon the first section of their undertaking were likely to cost a greater sum than had been estimated to be necessary for the four sections originally proposed to be executed, Sir C. Wood proceeded to state that in his opinion it was preferable that works of this public character should be executed by the State, which would be content with the mere payment of the interest on the investment, and would not seek to derive any profit from it. In fact, Sir C. Wood avowed his preference for the adoption of the system of Government, by which everything is to be done *for* the people—nothing is to be done *by* them; and, singularly enough, this proposition passed without challenge in a legislative assembly, charged with the interest of an empire, on which the sun never sets! This is the more remarkable, we would observe, that contemporary history ought to have taught our rulers a different lesson. We ourselves should have thought it a mere work of supererogation to discuss the subject, had it not thus been forced into notice; but as some of our leading statesmen avowedly entertain opinions we consider to be both false and practically mischievous, it behoves us at once to challenge them.

Now it is rather too good a joke for a branch of the English Government to cast in the teeth of a commercial company the reproach of having been deceived in its estimates; especially when, as Sir C. Wood himself avowed that those estimates must have been prepared upon imperfect surveys. Even in our own country, which has been surveyed and resurveyed, it is notorious that the Government never yet has been able to execute any important work within the limits of its original calculations. Two wrongs, however, never make a right; and the only inference we should draw from the habitual inaccuracies of Governmental estimates would be, that it was, at least, bad taste on the part of Sir C. Wood to dwell on the unfortunate mistake which the engineers of the Madras Irrigation Company have made. Moreover, as the Company has the great inducement of its private interest to urge it to exercise the strictest economy, it seems to us only natural to suppose that it would be even less likely to be deceived in this matter than Government engineers would be, who have no such powerful incentive to vigilance. Hydraulic works are at all times the most difficult to estimate correctly. In a country like India, where the hydrographical conditions are utterly unknown, and where the laws of nature act so differently from the manner in which they act in temperate latitudes, far greater latitude in estimating for them must be allowed than would be required in our own country.

The great error, however, of Sir C. Wood's political economy consists in the doctrine he avows that works for the improvement of any particular district should be executed at the expense of the State, and by State officers; or in other words, at the expense of the general body of the rate and tax-payers. But why should the dwellers on the sea-coast, or the trading classes of towns be taxed, in order that landed property should be improved? Why should the State take in hand the execution of irrigation works in a country where the roads are so notoriously bad that the cost of transport is admitted to increase the value of heavy goods as much as 400 per cent.? Can the State undertake the simultaneous execution of all the works supposed to be essential for the physical comfort of its subjects; and is Sir C. Wood prepared to execute harbours, docks, roads, bridges, railways, drainage, embankments, canals, river improvements, and the countless other works which are still wanting in India, and which are all of a more general and immediately pressing nature than irrigation works, important though the latter be for the agricultural interest? These are merely questions of temporary expediency, it may be admitted; but even if answered in such wise as to justify the desire of the Indian Government in, firstly, turning its attention to the particular case it has selected—the great question of the expediency of State intervention at all in such works as have been mentioned, still remains unsolved. The true functions of a government are, simply to protect individuals in the exercise of their own faculties—not to direct those faculties, and still less to save their subjects from the necessity of thinking, or of acting for themselves. In these matters practical illustrations are of greater value than theoretical reasoning, and it may throw light on the discussion to compare the results obtained respectively in the countries wherein the systems of State action, or of State abstention (so to speak), prevail Thus, in England and in America, the works of public utility are almost exclusively left to be executed by private enterprise; whilst on the continent of Europe those works are almost invariably executed by the State. Doubtless, with ourselves there is evidently a lack of solidity, a deficiency of taste in ornamental details, and an absence of monumental character in our roads, bridges, docks, and other analogous works; and our continental neighbours are exempt from these criticisms to a very great extent. But we have, by dint of our unshackled enterprise, enjoyed the advantages of the various methods of intercommunication, and of internal improvement, long before, and to a much greater extent, than the parentally-governed nations have done. It is possible that the mode in which our public companies are conducted, may often open the door to extravagance, and even fraud; and that our canals and railways may furnish many parallels to the mistaken estimates of the Madras Irrigation Company. But Government agents are no more infallible, and no more incorruptible, than are the agents of private companies; whilst the difficulty a State must always find in raising funds with sufficient regularity and rapidity for the economical execution of large works, must always materially increase the cost of the latter, in a degree which private adventurers would never allow. Thus, the cost of the canal system of France is said to have been less per mile than that of England; and so it was, if the sums actually paid for the works be alone taken into account; but it has been shown that the compound interest on those sums, accruing between the commencement of the several canals, and the dedication to the public service, was more than double the amount of the original capital invested. The element of the time employed in the execution of a work does not enter into the arithmetic of politicians of Sir C. Wood's school; yet, in India, where money commands so high a rate of interest, this must be a very important consideration; and if it were properly calculated, we fear that the glowing statements of the official engineers of the Indian Board would be very strangely modified.

The history of the works executed by the authorities of India and of their occasional suspension, for periods of more or less duration, in consequence of the pecuniary embarrassments of the Government caused by war, revolt, or famine, might have taught these lessons, had not the Indian politicians adopted as a principle that the Indian population required to be governed on the supposition that they were, in fact, minors under the guardianship of the Government. This doctrine is openly avowed by many continental political authors, and it is rigorously applied in all continental states; but it leads eventually to the fatal belief, on the part of the ruled, that all the calamities to which they may be exposed ought to be guarded against by their rulers. Governments are looked upon almost as visible Providences—not to speak it profanely—and are held responsible for whatever may happen by the operation of the laws of nature, so that they often depend for their stability on the results of a harvest. The aim of all true politicians ought, however, to be to render the bulk of the nation committed to their charge self-dependent and self-relying; and one of the most evident means of so doing is to encourage amongst them the spirit of association, for the purpose of executing works of what may be called local general interest, at their own cost, under their own responsibility, and at their own risk. If this spirit cannot be excited, then it seems to us that the course which should be adopted by the government of a country like India, is to encourage by every possible means, the investment of capital by private undertakers from amongst the ruling nation, in those large undertakings which the natives themselves are afraid to enter upon.

M. Cordier, in his work upon canals, gives a very simple formula for calculating the cost of a work executed by equal payments over a series of years, which it may be worth while to insert here, in case the discussion on the political economy of state intervention in public works should be taken up by any of our correspondents. M. Cordier calls the annual sum, say £600,000 s; the interest, say 5½ per cent., he calls i; the number of years he calls t; then the formula becomes, calling x the real cost—$x = s\left(\frac{1 \times i}{i}\right) t{-}1$. The formula he applied to ascertain the real cost of the Spanish canals, which remained for forty years in an unproductive state, in a country where the interest was at least 8 per cent, was, calling p the sum actually paid, 60,000,000 francs; the interest $i = 0{\cdot}08$; and the time, $t = 40$ years; $x = p\ (1 \times i)\ t$; or, in fact, the real cost was 1,303,473,000 francs; that is to say about twenty times the sum actually paid.

The great national and pecuniary interest England must feel in the prosperity of her great dependence must be our excuse for dwelling so long and so often as we do on that subject; but there are many things going on at home and in Europe, which are, perhaps, of as great importance to those who are interested in the pursuits of practical engineering. Thus, the preparations for the great Exhibition of 1862 are being urged forward with zeal and energy; the Dutch are building a huge structure at Amsterdam for the same purpose; and Italy, rising Phenix like from her long years of depression and servitude, proposes in 1865 to follow the same course, by inaugurating, on the 600th anniversary of Dante's birth, an exhibition of her arts and manufactures. How strangely these names and things mingle! Are we to suppose that there is any soul of poetry in industrial pursuits? In spite of M. Laprade's denunciations of the abuse of the mercantile spirit, we cannot but suspect that he has taken a false, because a limited, view of this subject; and we are convinced that the faculties of the human soul have not degenerated by reason of the development of modern manufacturing industry. Dante, great artist, great philosopher, as he was, would, we are sure, have entered warmly into the efforts now making to increase the material comforts of mankind; and we suspect that he would have watched with intenser, holier interest, the crowds who are likely to flock to the proposed industrial gathering at Florence, than he actually did watch the crowds flocking to Rome on the occasion of the jubilee. In the case of our own proposed Exhibition, however, several things have already occurred to shake public confidence in the spirit which animates its direction. The design of the building is simply atrociously ugly, and without the slightest pretension to artistic merit. The composition of the various committees is far from satisfactory, and the grouping of the various departments of industry is open to serious objections. All this may still be remedied; but it is to be feared that men who were so careless as to run directly into a violation of the law in their very first proceeding—viz., in commencing the building in direct contravention of the Building Act—are hardly likely to listen to criticism. *Absit omen.* Let us hope that, as they advance in their work, they may learn to defer a little to public opinion.

One of the consequences of the recent measures for the development of the railway sytem in North Wales, seems likely to be that the very important coal, stone, iron, and mineral resources of that district may be rendered more available than they hitherto have been. It is strange that, up to the present day, the Welsh landed proprietors should have exhibited so much apathy as they certainly have done in this matter; but they have roused themselves at last; the efforts now being made to complete the communication between Manchester and Milford Haven, through Newtown and Oswestry, must exercise a great influence upon the prosperity of the district so traversed. Its wealth is very great; all that it required in order to enable it to assume the busy, thriving air of the midland counties, was a system of rapid intercommunication with the manufacturing districts, and with a safe, deep-water harbour. Both these objects are now likely to be supplied, and we may hope soon to find the Denbighshire and Flintshire coal basin contributing its fair share of raw materials to the great centres of consumption. Just at present, when the newly-opened mineral district of the Ruhr, in Rhenish-Prussia, is entering so vigorously into competition with us for the supply of foreign markets, it becomes especially interesting thus to watch the progress of our own country and the facilities it is able to present for the supply of articles of such continually increasing importance as coal and iron.

The discussions between M. Frémy and his critics, upon the composition of steel, are being continued with a vivacity, and, we regret to say, a degree of acrimony which is perhaps likely to cause the subject to be studied with passion, even if scientific men should be made to bear rather an uncreditable character as polemists. In our last number we were not able to insert so much of the translation of M. Frémy's papers as we should have desired; but as we propose to publish the whole of them in due course, and the discussion they have raised is far from being closed, the trifling delay will not produce any inconvenience. M. Chevreul, another member of the Academie des Sciences, has lately published some important *memoires* on the science of dyeing, to which attention will also be called hereafter in these pages.

In London, the vexed question of the relations between master and workman remains in as unsatisfactory a state as ever; and there seems to be only too great a probability that the Builders may suffer again from a strike of the same general and bitter character as the unfortunate one of 1859. The *Times* has done serious mischief in this matter by its very injudicious interference; and by crying "Peace, where there is no peace," it has diverted public attention from a social problem of a very complicated nature, whilst the incorrect statements that journal has published of the grounds of quarrel, have raised prejudices it may now be hard to dispel. According to the *Times*, the quarrel between the London masons and some of the large building firms, arises simply from the attempt of the latter to establish the system of payment by the hour throughout the whole of the week; the workmen, however, object that the introduction of this system would deprive them of the advantage of the short day on Saturday. Substantially, the payment by the hour has always prevailed amongst London masons—and we speak confidently on this subject, because in our own early days we worked "at the banker," and have now been connected with building operations for at least thirty-two years;—but of late years the Saturday has been counted in a different manner from the other days; and eight hours in its case have counted for ten hours on the others. Now, the workmen know that the competition for skilled labour must soon cause a rise in its money value; and as that value is reckoned at so much per day, they see that if they allow the unit of value to be changed nominally, they will in fact lose the advantage they actually enjoy from the Saturday arrangement. There seems to have been a want of candour and a want of a proper conciliatory spirit between the parties in this dispute, for the real facts at issue have never been stated; and if we might venture a suggestion, it would be to urge both parties to refer the question to an equitable council of arbitration.

Practical mechanical engineers seem of late to have learned wisdom from their past struggles; and they are now working together for the development of their noble science. In marine steam engines, the consequences of this harmonious action would appear to have made themselves the most distinctly felt; and the introduction of the new system of superheating the steam, and of surface condensation, has been aided, perhaps as much by the intelligent assistance of the workmen as by the skill of the inventors. Opinions as to the precise amount of advantage to be gained by either of these processes at present vary; and the Chairman of the Peninsular and Oriental Company lately stated that in some of the boats of that Company the saving of fuel by the use of superheated steam was only about 10 per cent., whilst in others it amounted to as much as 25 or even 40 per cent. Practical experiments, on the scale which such companies as the Peninsular and Oriental one, are able to undertake, are of inestimable value in the case of new inventions; and it is to be hoped that not only will they be continued, but that the results will be placed before the public in an authentic form. If an economy of fuel of only 10 per cent. can be secured without any detriment to the working part of the engine, or any serious increase in its first cost, the importance of the system which so secures the economy cannot be exaggerated. As to the surface condensation, there do not appear to be any recorded experiments, on a sufficiently large scale, to warrant the formation of any definite opinions on its merits, at present at least.

At Glasgow, it appears that the Commissioners of the Clyde Navigation are still earnestly engaged in the course of the operations for the improvement of their river; and in France the State engineers appear to be equally energetic in their attempts to improve the Seine. Meanwhile, we in England are allowing our rivers to become comparatively useless; and even opposite the Government establishments of Harwich, and of Sheerness, the Orwell, the Thames, and the Medway are allowed to silt up gradually, without any serious or consecutive efforts for their improvement. It really is disgraceful that the Orwell, in particular, should be allowed thus to become useless; for its mouth furnishes almost the only harbour of refuge on our East Anglican shores; and the natural causes now at work to silt it up, are sufficiently known, and sufficiently well understood, to enable a judicious scheme for the improvement of the river to be attempted.

Several patents have been taken out of late for tramways in common roads; and the question still occupies public attention; but we think that the general tendency of public opinion is unfavourable to the introduction of the system near large towns. A patent lately taken out by Mr Charles Burn, seems to us to have obviated some of the most serious objections to the use of grooved trams; the other objections may also in time be removed. Judging, however, by the sample laid down in the Bayswater Road, we confess we look unfavourably on the whole system.

HYDROSTATIC PRESSES.

THE ordinary safety valve, as applied to the hydrostatic press, has often been a serious annoyance to those practically acquainted with the working of such presses, more especially when two or more are wrought by one set of pumps driven by steam power. Messrs John Bingley & Co., of Leeds, Engineers, who have, from time to time, introduced many improvements in the details and construction of hydrostatic presses, have recently obtained a patent for some improvements which effectually remedy these defects.

The safety valve of the pump, as generally constructed, is a small conically-seated valve held down by a weighted lever. The orifice and seat of the valve, in consequence of the very high pressure employed, must necessarily be of small dimensions, often less than a quarter of an inch in diameter, and when held down by the great weight required to counterbalance the enormous pressure acting on so small a surface, the valve frequently adheres to its seat, and is thereby prevented from lifting until a much higher pressure than that calculated upon has been applied. This is the cause of frequent accidents to pump and press; even when adhesion does not occur, and the valve is raised by the ordinary full pressure, it not only lets off the surplus water or other liquid, but also allows considerably more to escape from the press at the same time, and before the valve closes again the pressure has become so much below the proper maximum that it must again be forced up with another risk of breakage. When two or more presses are wrought by one set of pumps, if the connection be opened with a newly charged press, after the others have been forced up to the full pressure, and the pump is still working, an adequate and safe self-acting means of preventing the pressure from returning and entering the newly-started press has heretofore been wanting. This is particularly inconvenient and injurious in the working of hydrostatic presses when applied to expressing oil from seeds and other substances. The pressure in these operations is generally put on while the material is hot, the oil begins to run off when the pressure attains a certain point, and continues to do so while any remains to be extracted, so long as the full pressure is maintained. But by starting a newly-filled press, as before explained, the pressure is reduced; the oil ceasing to run off, is re-absorbed into the seed, and this continues until the pressure on all the presses connected is again got up to the higher point. In the meanwhile, the temperature having become reduced, greater power is now required, and thus loss of produce, time, and power is the result.

Messrs Bingley's arrangements render the working of this now almost universally applied press more controllable and safe. Figs. 1 and 2 of the accompanying engravings represent one part of these improvements, and consist chiefly of a new safety valve constructed on a principle entirely different from that of the conical valve ordinarily used. A small ram truly turned and polished is fitted into a cylinder made to slide smoothly through a close, water-tight collar of leather or other suitable material. This ram receives the pressure, and is weighted while in its place, in any convenient way, either by a spring, a pendulous, or other lever, or a weight, as is most suitable to the particular case. The motion of this ram, as the pressure increases or diminishes, is communicated through the intervention of rods and levers, contrived to act upon the "suction" valve of the pump, so that when the pressure attains the desired extent the apparatus lifts this valve from its seat and entirely prevents any increase of the force already in the press, but, at the same time, does not in any way diminish it, as is the case with the old safety valve.

The plan for preventing the return of the force from presses under full pressure, to others under light pressure consists simply in the application of a self-acting valve to each press, opening towards the press, but closing towards the pump and the other presses. This effectually prevents the heavy pressure from returning and leaving its work, but still admits the force from the pump to the newly-charged press; and when the pressure again attains the maximum it is applied alike to all the presses. In oil presses, a very important saving in time, labour, and power, besides an increased quantity of oil extracted is effected.

The accompanying engravings represent one example of the application of these improvements. Fig. 1 represents an ordinary hand-pump in section; A, is the pump cistern; B, the pump; C, the handle or lever for working the same; D, is the ram and cylinder which receive the pressure, and, in this instance, is weighted by a pendulous lever, E, and weight, F, but it may be weighted by springs or other contrivances. The ram has a toothed rack, G, attached to it, working in a segment, H. So soon as the pressure attains the required extent, a tappet, I, fixed to the ram strikes upon a tappet, K, on the lever rod, which tappet is moveable and adjustable to various pressures. The rod, L, connects the latter tappet with the lever, M, and through that lever to the rod, N, which latter rod when acted upon lifts the suction valve, O, from its seat, and effectually prevents the pump from forcing any more water into the press. A turn-over lever, catch, or spring, or other similar contrivance, can be attached to the rod, L, so that when lifted by the action of the ram it is retained in that position, until released by the attendant, when it is again ready for action. Without this catch, the apparatus is entirely self-acting, and always returns to its original position, when the pressure is relieved. An index-plate and pointer to enable the attendant to stop the pressure is attached, so that the safety of the presses and machinery is absolutely ensured at all times.

Fig. 1.

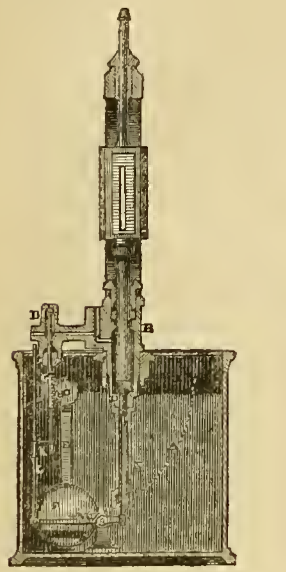
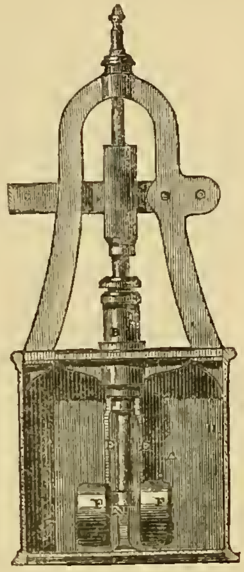


Fig. 2.



In cases where there is no "suction" valve, the ram which receives the pressure may be connected with another valve or outlet, as circumstances may render most convenient. This new form of safety value is also applicable to steam boilers, and may be used generally in all cases where undue pressure is to be guarded against.

THE UNITED STATES PATENT LAWS.

The Commissioners have just issued a set of rules, under the recent Act of Congress, some of which bear importantly upon the applications made by foreigners. We therefore append the following extracts, for the information of our readers:—

The taking out of a patent in a foreign country does not prejudice a patent previously obtained in the States; nor does it prevent a patent being subsequently obtained in the States. When the patent is granted in the States, after being obtained abroad, it will extend only 17 years from the date of the foreign patent.

An applicant, in consequence of his having obtained a foreign patent, should (temporarily) file in the Office the patent so obtained, with the specifications (provisional or complete) attached, or a sworn copy of those. But where such papers or copies cannot be conveniently furnished, it will be sufficient if the reasons of such inability be set forth by affidavit; and the applicant shall also state the fact that a foreign patent has actually been obtained, giving its date, and showing clearly that the invention so patented covers the whole ground of his present application.

If an alien neglects to put his invention on public sale, within 18 months after the patent is granted, and to continue it on sale to the public on reasonable terms, his patent will cease to protect him.

In all cases not capable of illustration by model or drawings, duplicate specifications will in future be required to be filed when the application is made;—one of these will in no case be permitted to be taken from the Office.

THE APPLICATION OF CRYSTALLOGRAPHY TO MINERALOGY AND GEOLOGY.*

Crystallography is a science of the greatest importance, both to the chemist and mineralogist. So far as chemistry and mineralogy are essential to the geologist, crystallography must bear its share. It is however of some special advantage to the geologist. There are certain veins or rents in rocks which have been filled with mineral substances; these substances have formed crystals, either by cooling from a fluid state, by sublimation, or by being deposited from solutions the fluid portion of which has evaporated.

Sometimes a part, or the whole, of these crystalline substances may be removed, yet traces of the previous existence of those so removed may be faithfully preserved.

Thus, crystals of carbonate of lime may be first deposited. These crystals may be completely coated over with others of quartz. The carbonate of lime may then be removed by some solvent acting upon that substance, but having no effect on the quartz; there is then left a mould of the carbonate of lime crystal in the quartz. This may then be filled by some other substance which would not naturally assume the form in the mould of which it is deposited. A crystal so formed is called a pseudo-morphus form. It indicates to the geologist or mineralogist the certain proof of the previous existence of a body in the vein, which has been afterwards removed by some geological change. Those who are familiar with rocks know how frequently the successive crops of crystals which have been deposited in their veins point out the successive injection into them of various mineral substances. But there is one other point to which attention may be called; and that is, to a fact which seems to be slowly evolving itself, namely, that crystals are natural pyrometers. They afford a means of obtaining the temperature at which they have been formed. This may be shown by an experiment within the reach of every one. Make a solution of common alum in boiling water, putting into the water as much alum as it will dissolve. Hang up in this solution a few threads or wires. As the solution cools, these threads will be covered with beautiful transparent crystals. If these crystals be taken out of the solution, and examined before it has cooled to the ordinary temperature of the atmosphere, they will present faces of the regular octahedron only; the octahedron being a form which is bounded by eight equilateral triangles. Having examined these crystals, hang them again in the solution, and leave them a day or two in it, at the ordinary temperature of the atmosphere. Take them out again; you will find they have grown, but grown in such a manner as to lose their octahedral forms. Their solid pointed angles will all be replaced or cut off by planes, which are squares. These planes are parallel to those of a cube, and the new crystals are said to be combinations of the two forms of the cube and octahedron. If crystals be formed not about the octahedral nuclei in this same solution, but allowed to deposit themselves spontaneously, they will take on the form of the perfect cube. The form of a crystal of alum, whether it be that of an octahedron or a cube, or a combination of these two, affords a certain indication of the temperature at which it was produced. Common salt, crystallized at the ordinary temperature of the air, forms cubes. If it be rapidly crystallized, however, on a piece of heated glass, it produces octahedrons. The same influence of temperature is shown in the case of carbonate of lime. Dr Miller tells us that if it is crystallized from its solution in water containing carbonic acid, at the temperature of boiling water, or is precipitated by pouring a boiling hot solution of chloride of calcium into a solution of carbonate of ammonia, also boiling hot, it takes the form of aragonite. When it crystallizes from a solution at the ordinary temperature of the atmosphere, or from fusion, it takes the form of Iceland Spar. Thus we find that the influence of temperature not only applies to those forms of crystals which belong to the same system, but also, as in the case of carbonate of lime, to what are called dimorphous bodies, because they assume forms pertaining to two different systems of crystallization. The observations made with regard to carbonate of lime apply also to common nitre, which is isodimorphous with it. These instances are by no means solitary examples of the influence of temperature on the forms of crystals. Should it be found to follow a general law, crystallography will afford the geologist one of the most important means of determining the history of the formation of crystalline rocks.

Mr Clifton Sorby has made an important application of the subject of crystallography to geology. He has called in the aid of the microscope. He makes thin sections of granitic and other rocks composed of crystals.

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* A Lecture delivered by the Rev. Walter Mitchell, M.A., before a Meeting of the Geologists' Association.

These crystals have many minute holes or pores. If the crystal has been formed from a fluid solution, these minute pores are seen under the microscope partially filled with liquid. If they have been formed by slow cooling from a molten mass, the pores indicate this fact. By these means Mr Sorby has been enabled to deduce some important geological theories.

There is one other geological subject on which crystallography throws some light. The very difficult one of slaty cleavage. The cleavage of crystals affords almost the only means of arriving at the laws of those definite directions in which the slaty rocks are so often split.

When the particles of any substance assume a solid form, provided those particles are allowed to arrange themselves under the influence of their mutual attractions, they will assme the form of crystals. These forms are almost always bounded by perfectly flat or plane surfaces. In the few instances where they appear curved, the curvature is more apparent than real. The appearance of curvature being caused by a number of planes slightly inclined to each other.

Crystals may be formed in a variety of ways. They may be formed by the evaporation of a fluid which holds the crystalline substance in solution. They may be formed by the passage of a body from the fluid to the solid state, as in the case of most metals. They may likewise be formed by being deposited from the vapour of a volatilized body.

Sulphur affords an example of crystals formed by each of these methods. Crystals of sulphur may be deposited from its solution in naphtha, or some hydrocarbon. They may be obtained by pouring melted sulphur in a molten state into a mould, waiting until the surface is solid. The solid crust is then broken, the molten mass still fluid in the interior is poured out, and the inner crust is found studded with crystals. The beautiful crystals of sulphur found on lava in volcanic districts are formed by being deposited form the sublimed vapour of that body.

Bismuth, melted and cooled, as mentioned in the case of sulphur, affords an interesting example of metallic crystals. With regard to the formation of crystals by sublimation, the value of the appearance of the crystals of arsenious acid as obtained by the sublimation of arsenic, may be instanced. This affords the chemist his ultimate test for the presence of the most minute portion of this deadly substance in any fluid or substance, however skilfully disguised.

To obtain that elementary knowledge of crystallography which is so useful, both to the chemist and mineralogist, we must take some few lessons on form. We must be able to recognize the principal crystals, in whatever direction they present themselves to our view. If we wish to make a more extended acquaintance with the laws of crystallography we must make ourselves masters of a considerable portion of solid geometry. To attain this, there is no royal road. But its difficulties may be considerably smoothed, and a useful knowledge acquired, by very simple means.

Every person commencing the study of crystallography, is strongly recommended to make models of the chief forms for himself. He will learn more by making one model for himself, he will become more familiar with its appearance under different aspects, in one half-hour thus employed, than by days of study without this aid. The reason why solid geometry is so repulsive to many minds is, that they attempt to master it simply by drawings on a plane surface. Whereas, if they would use—or, better still, make—a model of the form to be studied or investigated for themselves, solid geometry would become as easy and intelligible as plane geometry.

As an example:—describe on a piece of pasteboard an equilateral triangle, which any one can do from the first proposition in Euclid, bisect each of the sides of this triangle, which, as its name implies, are all equal, and draw lines joining each of these points of bisection, the triangle will be divided into four equilateral triangles. Now, if we cut out the original triangle with a pair of scissors, and draw a pen-knife lightly over the three lines joining the bisected edges, so as to cut only half through the pasteboard, the flat piece of pasteboard will readily fold up into the form of a regular pyramid on a triangular base. The edges may be fastened together with a dot of sealing-wax, or a little glue, and you will have a very good model of the regular tetrahedron. This is one of the Platonic bodies, or regular solids, and occurs also in nature, as the form of a crystal. Eight such triangles as these, arranged in this manner (indicated by the lecturer on a black board,) will give the regular octahedron. This form is bounded by eight equilateral triangles, and is another of the Platonic bodies, and occurs as a very common form among crystals. Now, by making two such models as these, handling them and viewing them in every aspect, you will learn properties and appearances of these forms which you could never familiarize yourself with by drawings of them on a flat surface.

A cube is easily formed by arranging on the cardboard six squares in the form of a Roman cross. The diagrams for cutting out the principal forms of crystals are now given in many books of crystallography. They are called "nets" for crystals.

All crystals are not so simple in their forms as these. There are many crystals described, having hundreds of faces or planes on the same crystal. The varieties of forms are endless. Many hundred forms of crystals—each of these forms possessing from six to more than a hundred faces—have been drawn, described, and measured, composed of only one substance, carbonate of lime. Now, it is one branch of crystallography to read, describe, and reduce these complicated forms to their simplest and most symmetrical elements. These complex crystals of carbonate of lime defied all the powers of Haüy to resolve them into their simple elements, until one day he accidentally broke a magnificent crystal. Gathering the fragments into which it had broken, he was surprised by their similarity. He measured the angles of these fragments; he found all that came from the interior of the crystal gave but two angles; he broke these fragments into smaller ones; he obtained still these two angles, and no others. He broke other crystals of carbonate of lime; all alike gave similar fragments, with identically the same angles. He then tried to break crystals of other substances. He found some of these readily giving simpler forms than the external crystal; these simple forms having angles which were identical for crystals of the same substance, but differing for different substances. This law of cleavage, as it is called, gave Haüy the hint for simplifying the forms of crystals. He arranged all known forms under six distinct groups or families—a division which remains to the present time.

We will take the first of these groups by way of example. This is the cubical or octahedral system, and is so called because either the cube or octahedron may be taken as the typical form of the system.

In this country, fluor spar generally crystallizes in the form of the cube. Take one of these cubes, and draw diagonals across every one of its six square faces or planes. Now take a knife, place its edge along one of these diagonals, and incline the blade of the knife in the direction of the two diagonals of the two squares which join the two extremities of the diagonal on which the knife is placed. Give the back of the knife a sharp blow with a hammer, and a piece will be split off the cube bounded by the three adjacent diagonals. A new face will now be exposed, which will be an equilateral triangle. Proceeding in this way with the remaining square faces, we shall detach three more fragments, displaying three more triangular faces. The piece which remains will be a regular solid, bounded by four equal equilateral triangles. We thus obtain by the law of cleavage a regular tetrahedron from a cube of fluor spar.

We now take this regular tetrahedron—it has six equal edges. We bisect each of these edges, and join the points of bisection by scratching lines on the crystal. We place the edge of the knife on one of these lines, and hold the blade in the direction of two similar lines on two adjacent faces to the one on which we place the edge. We give another blow with the hammer, and we detach a fragment which, on examination, proves to be itself a regular tetrahedron. This we have obtained by splitting off one of the solid angles of the original tetrahedron. We proceed in like manner to split off the remaining three solid angles. The nucleus which remains is another regular solid body. It is bounded by eight equal equilateral triangles, and is the regular octahedron. Hence by cleavage we have obtained from the cube of fluor spar two of the Platonic bodies, the cube itself being another. Replacing our fragments, we may readily see how the tetrahedron has been geometrically inscribed in the cube, and the octahedron in the tetrahedron. In point of fact, you will discover that nature itself has demonstrated to you two propositions out of the last, the fifteenth book of Euclid. A matter perhaps not insignificant, if we remember that Plato only described these three of the so called Platonic bodies, and that he prophesied that they contained hidden in their properties the secrets of all material laws. We thus find by cleavage a natural connection between the three forms—the cube, octahedron, and tetrahedron. The diamond possesses the same properties—so far as crystalline form and cleavage is concerned—as fluor spar. All crystals of the diamond, though that substance is the hardest in nature, break readily, cleave or split in the direction of the regular octahedron; these directions of cleavage having always a definite relation to the external form of the crystal.

The diamond not only has the octahedral cleavage above described—so that out of a diamond crystal in the form of a cube you can easily split out a tetrahedron and an octahedron—but its crystals, without cleavage, may assume these two forms. Besides these two forms, the diamond may assume other simple forms; all differing considerably from one another. More puzzling still, these forms may be combined in the same crystal. Thus a cube may have its solid angles cut off, or replaced, as its called, by eight equilateral triangles. These eight triangular faces are parallel to the imaginary or cleavage octahedron inscribed in the cube; we call them, therefore, octahedral faces. The crystal is said to be a combination of the cube and octahedron. Among the simple forms of the crystals of the diamond is a very pretty symmetrical form, bounded by twelve planes. Each of these planes are rhombs or lozenges. It is called the rhombic dodecahedron. It is a very common form of the garnet. Half of this rhombic dodecahedron is a perfect mould of the bee's cell. If you hold it in such a position as to look down on one of its solid angles formed by the union of three planes, you will see that these three planes, or lozenges, represent the bottom of a bee's cell, and the six adjacent faces the six walls of the hexagonal cell. Moreover, the angles of these rhombs are identically those of the bee's cell. The larger plain angle is 109° 28′; the smaller 70° 32′—the very angles which give to the bee's cell the greatest space with greatest economy of material. A patient German naturalist discovered that the great angle of the bee's lozenge was invariably 109° 28′. A mathematician calculated what it should be to give the greatest possible economy of material with the greatest amount of space; he arrived at the angle 109° 26′. He thought the bee had made the small error of 2′. Subsequent examination, however, showed the bee to be right; and that the mathematician had been misled by a blunder in his logarithmic tables.

These three forms of the cubical system—the cube, octahedron, and rhombic dodecahedron—are called the three invariable forms of the system. Their angles, whether of the inclination of their faces to each other, or of the sides of the faces to each other, are invariable. Between these forms there are other variable forms which, while retaining a general resemblance to each other, vary in their angles. The relationship of these variable forms to each other, and the invariable forms of the cubical system, Mr Mitchell demonstrated by models and coloured diagrams. Lastly, he showed by a kind of armillary sphere, in which an octahedron was inscribed, how all these forms might be made to pass from one to the other, through all their infinite changes, by only pulling two different strings.

A discussion followed, in which several members took part, and in the course of which Professor Tennant said that the lecturer had had a difficulty in condensing this very comprehensive subject. He had been giving the pith of twelve lectures in one hour; which was giving the history of England in the same time. Crystals, formed as it were, the flowers of minerals; and held the same relation to the inorganic kingdom as flowers did to the vegetable. A person in California found a substance, and not knowing what it was, took it to a jeweller for examination. The jeweller took a file and tried to file it, but could not; he then drew it across a piece of glass, and found that it scratched the glass. Supposing it to be a diamond, the jeweller offered £200 for it. "Oh," said the finder, "if it is worth £200 to you, I am going to England, and will take it with me." He showed it to several jewellers in England who knew no better. He then brought it to him (Mr Tennant) with a letter from a friend, asking him to examine the substance. He asked what was the value of the stone. To which he (Mr Tennant) replied, "If you want to buy it, perhaps you would have to give four or five shillings for it; but if you want a quantity of them, I dare say you could have them for a couple of shillings or half-a-crown each." The substance was a transparent crystal of quartz, in the form of a six-sided prism, terminated at each end by six sided pyramid; the diamond never occurs in this form, but usually in the shape of an octahedron or rhombic dodecahedron.

Now, this was one of the practical applications of crystallography. He showed him also that its quality could also be known from its specific gravity. The owner stated that it would scratch glass; on which he (Mr Tennant) showed that a flint would scratch glass, and so would sand, the topaz, the emerald, corundum, and many other stones. He was sorry to say that crystallography was a subject very much neglected; though in France and Germany they knew more about it than in England. At the close of the Exhibition of 1851 the Koh-i-noor diamond was found to contain some flaws. He and Mr Mitchell were sent for to Buckingham Palace, to see how large a perfect form could be obtained from the imperfect one. A calculation was made, and instructions were given to a lapidary at Amsterdam to reduce the diamond to the perfect form. It weighed 186 carats in the Exhibition, and was reduced to 103¼ carats in the process of rubbing off the broken pieces. The same workman had since been engaged in cutting the "Star of the South," a very large diamond exhibited at the Paris Exhibition. Going through the interesting diamond cutting works the other day, at Amsterdam, he found about one thousand persons employed in cutting diamonds. The workmen were all of the Jewish persuasion. His friend, Professor Pole, was with him. A wheel was used during the process, and revolved at the rate of 800 times a minute; and could be regulated to any required speed. Nine-tenths of the workmen knew nothing of crystallography, and were only guided by long practice.

SELF-ACTING ENGRAVING MACHINE.

JOHN GLEN, *Engraver, Glasgow, Patentee.*

(*Illustrated by Plate* 274.)

THE transfer of engravings from one metal on to another has been practised in this country for more than half a century, and amongst the many successful inventions which have from time to time been added to the Mill machine for engraving calico-printing rollers is the subject of our plate, which shows that a great stride has been effected in a strikingly simple and economical manner. Mr Glen's aim has been to render the present common engraving machine self-acting, and he has thus far succeeded that one workman has now no difficulty in attending two machines operating simultaneously; and as the die-cutter has only one object to engrave, three or more patterns may be put upon one piece of steel, considerably saving material and clammer's wages. The accuracy of the movements of this improved machine has been tested for some time past in Messrs Wagstaff, Glen & Collins' manufactory, William Street, Glasgow. The accompanying plate, 274, represents a perspective view of the complete machine, drawn from sketches taken from one of the machines now at work.

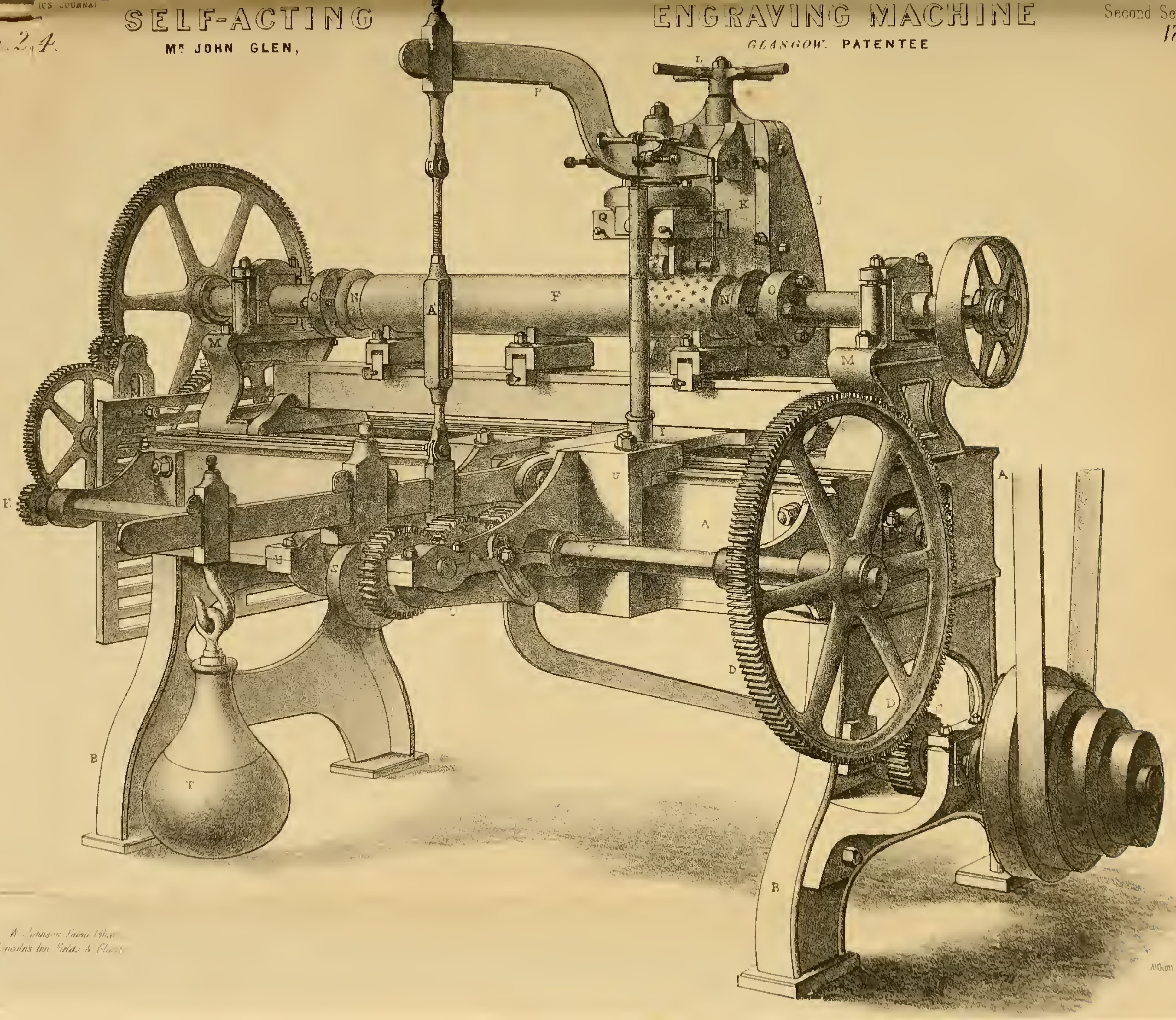
The machine bed, A, is supported upon two end frames or standards, B, the one nearest the eye carrying the driving cone and pinion, C, in gear with the spur wheel, D, keyed on a horizontal shaft running in bearing brackets bolted to the side of the main bed of the machine, A. This shaft extends the whole length of the machine, and is projected as far beyond so as to attach the change wheel gear pinion, E, thereto, and in gear with a series of change wheels and pinions which drive the feed screw and copper roller, F, at the proportional speeds required. The feed screws being in the centre of the main bed of the machine, cannot be seen, still one of the end bearings is shown at G. This shaft projects sufficiently far beyond the other end of the machine that its driving wheel, H, may be properly keyed thereon. A nut in the centre of the screw shaft is fixed to the lower side of the slide, I, which has bolted thereon the upright standard, J, which of itself is formed so as to receive a vertical slide, K, which can be raised and lowered by turning the cross arms, L, fast on the upper end of the vertical screw which works the slide, K. The roller, F, to be engraved is supported on a horizontal shaft running in two end bearings bolted on brackets, M, erected at each end of the main bed. This roller is hollow throughout, and is hung truly by means of tapered wedges, N, one at each end of the roller, so regulated by pinching screws passing through the adjustable collars, O, that the roller to be operated upon is thus firmly and truly hung. These collars, O, can be set at any distance apart to suit the different lengths of the rollers, and are fixed at the proper distance apart by pinching screws passing through their periphery on to the surface of the roller shaft. The front part of the slide-block, K, forms a bearing to receive the spindle of the overhead lever, P, which carries the supporting frame, Q, of the mill, R. This lever, P, has fitted to it the moveable screw link, A^1, which connects it to the lever, S. This lever is centred on a pin which is supported in a projecting part of the carriage or slide, I, and at its outer extremity it carries a moveable counterweight, T. On the front part of the carriage, I, is cast a pair of brackets, U, through the inner parts of which is passed the horizontal shaft, V, which derives its motion from the driving end of the machine. Keyed to the shaft, V, is a wheel, W, which is in gear with the intermediate wheel, X, and this wheel gives motion to the wheel, Y, on the transverse spindle of which is keyed a cam, Z, the rotatory motion of which causes it to raise the tappet, *a*, and so communicate a vertical reciprocatory movement to the lever, S. The cam spindle and its connected parts are arranged so as to be readily shifted from its bearings when an alteration in the size of the wheel, Y, or a different cam, Z, or other detail is required. The metal roller, F, to be engraved is arranged on the mandrel, as already described, and the pressure of the mill, R, upon its surface is regulated by the position of the counterweight, T, which draws down the lever, S, and with it the lever, P. As the copper roller, F, rotates, it imparts a corresponding motion to the mill, the relievo lines of which are impressed in the roller. But the instant the mill has made a complete rotation it must be raised from the roller or the pattern would be continued all round the roller, and where this is not desired the improvements provide for the ascent and descent of the mill at regular intervals. This is effected by means of the cam, Z, the rotatory motion of which lifts the levers, S and P, and so raises the mill from off the surface of the roller, F. The movement of this roller continues during the time that the mill is kept up by the cam, so that upon its descent the impression is made upon another part of the roller, the distances these impressions are asunder being regulated by the change-wheel gearing of the machine, which causes the roller to rotate at a given speed, according to the number of figures to be impressed thereon. These intermittent movements of the mill, combined with the lateral motion of the carriage, causes the surface of the roller to be impressed at regular intervals with the design imparted from the mill. An arrangement is also provided to insure the mill commencing its impression at the corresponding part of the design each time that it descends on to the roller. By means of the screw link, A^1, the distance between the levers, P and S, may be varied so as to regulate with the utmost nicety and accuracy the time which the mill is in contact with the roller. So also by moving the tappet, *a*, along the lever, S, the eccentric may be caused to only slightly raise it at each rotation, and so cause a rapid rise and fall of the mill, or a prolonged contact with the roller as the peculiarities of the pattern may require. On the journal of the mill, R, is fixed a small vertical lever, *b*, to the upper end of which is attached a cord, the other end of which is connected to a weight. The cord passes over a pulley which is carried on a stud projecting laterally from the

Plate 2,4.

Second Series
Vol. VI.

SELF-ACTING ENGRAVING MACHINE

Mr. JOHN GLEN, GLASGOW. PATENTEE



W. Johnson, Patent Office,
47, Lincolns Inn Fields & Glasgow

Aitken & Faire Glasgow

Plate. 276.

VERTICAL TURBINE,

MR C. SHIELE'S, *OLDHAM*, PATENTEE,

MANUFACTURED BY

THE NORTH MOOR FOUNDRY Co, OLDHAM.

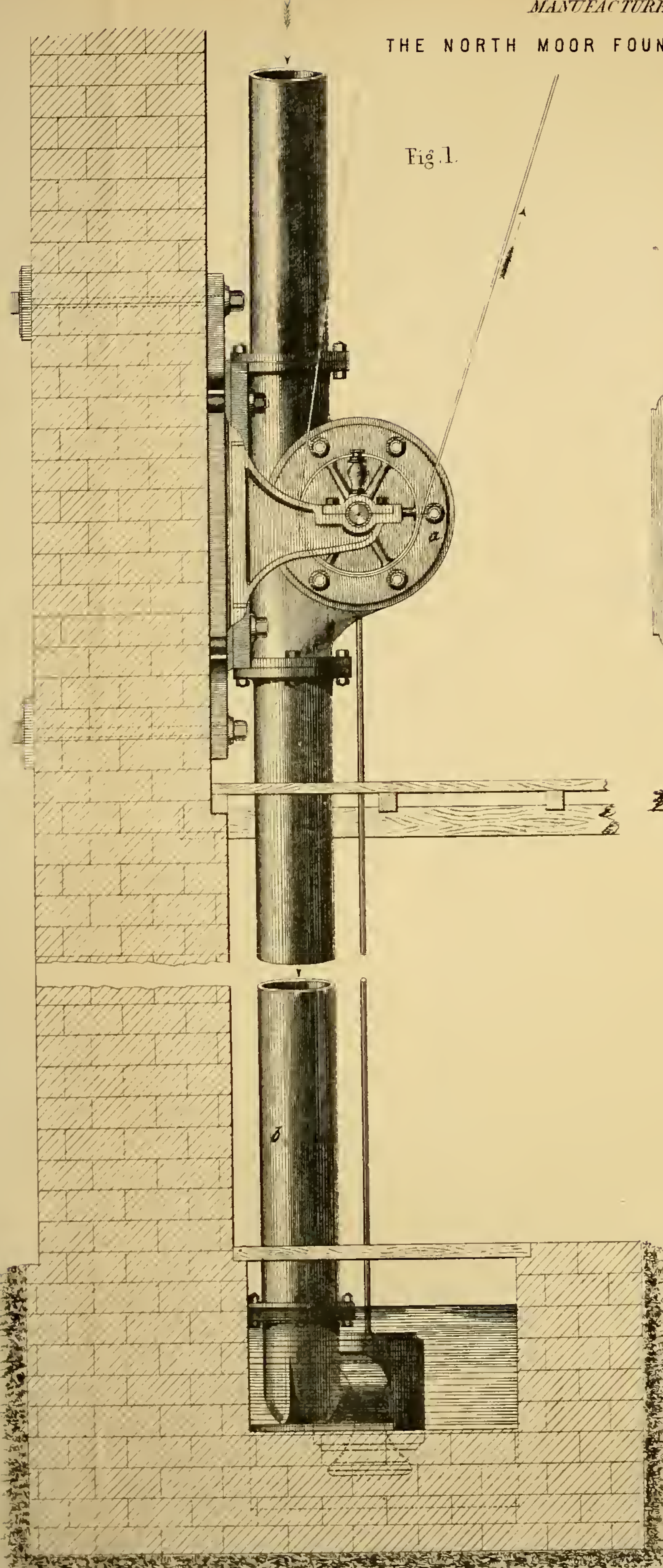


Fig. 1.

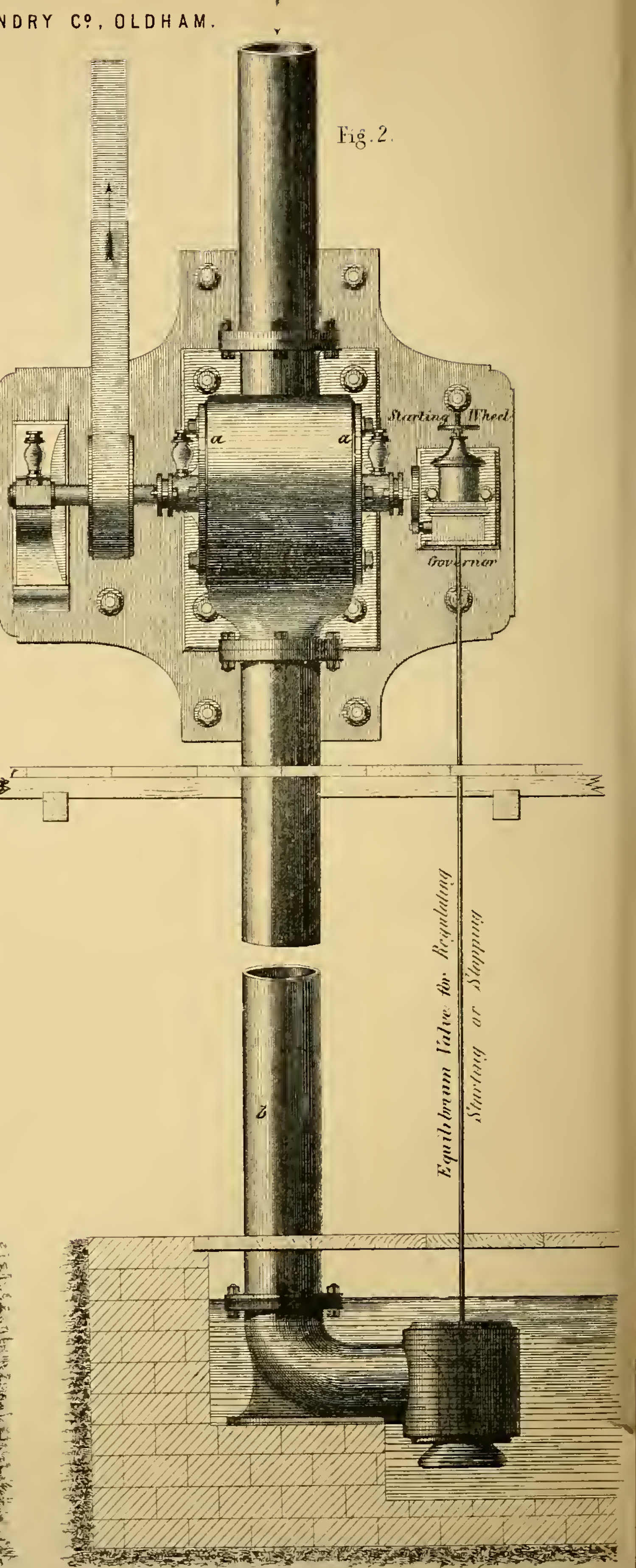


Fig. 2.

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Mackay & Kirkwood Glasgow

Plate 275.

HORIZONTAL TURBINE,

MR C. SHIELE'S, *OLDHAM*, PATENTEE,

MANUFACTURED BY

THE NORTH MOOR FOUNDRY Co. OLDHAM.

Fig. 1.

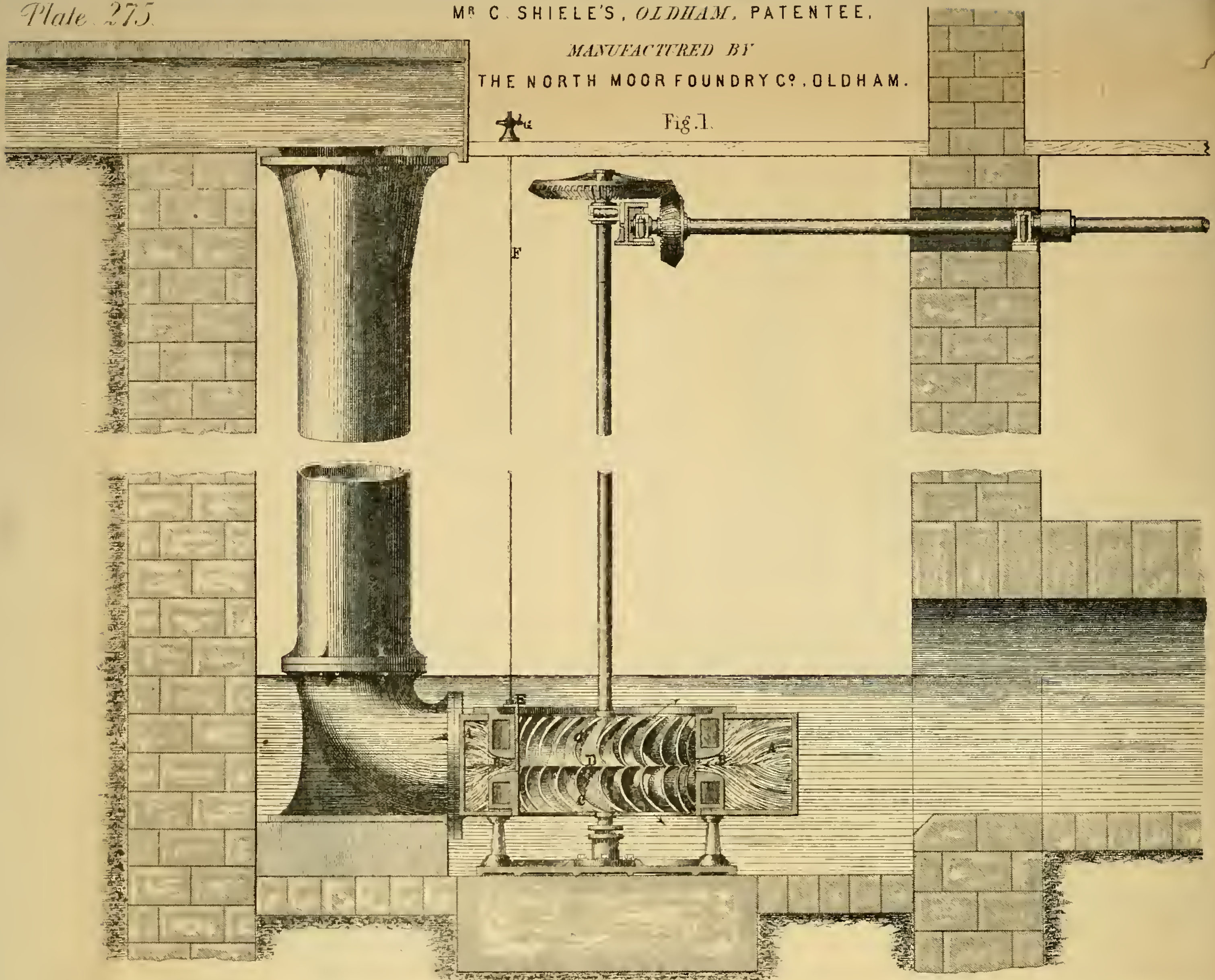
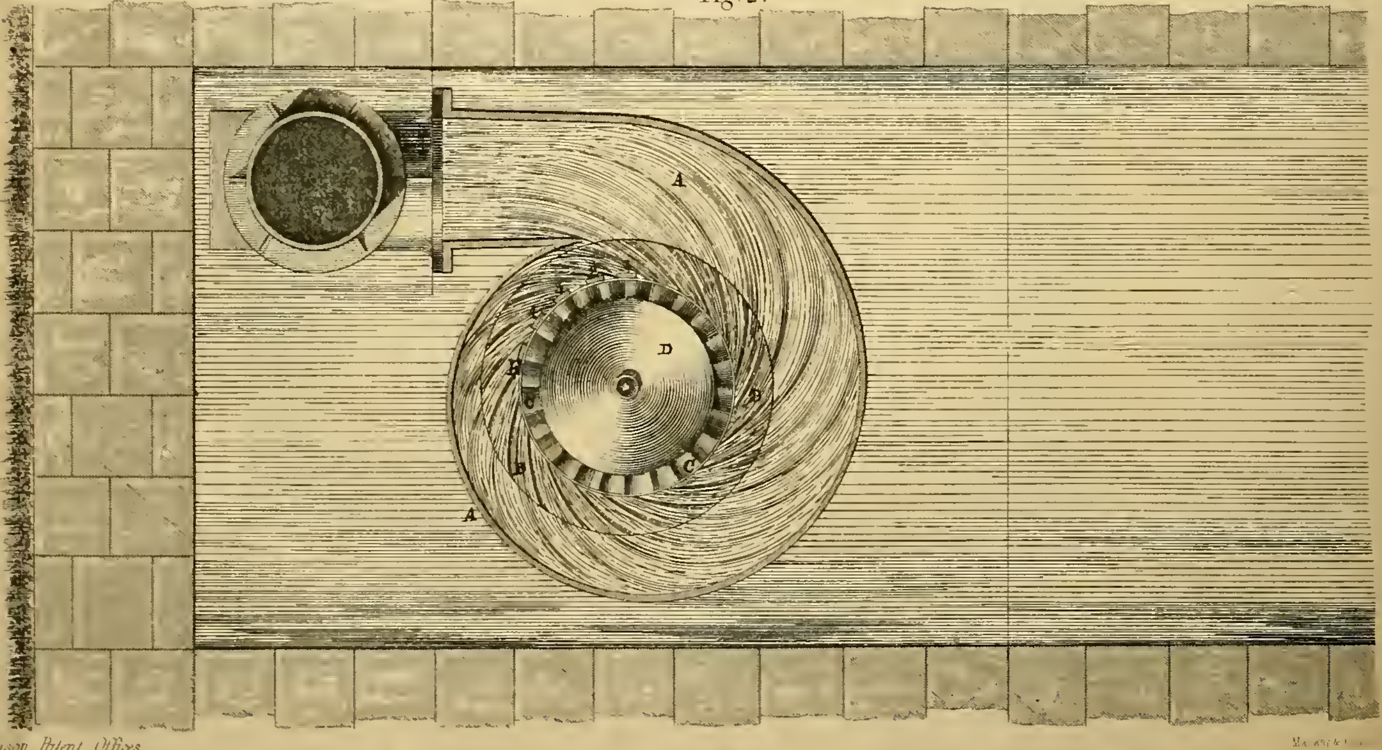


Fig. 2.



W. Johnson Patent Offices.
Lincoln's Inn Fields & Glasgow

lever, P, the weight attached to the string is passed down the vertical tube, *d*, which forms a guide for it. As the mill, E, is moved round upon its axis, when in contact with the copper or other roller, F, the lever, *b*, moves from the vertical towards a horizontal position in a backward direction. When the impression of the mill is completed on the roller, and the lever, P, is raised prior to repeating the pattern from the mill, the weight attached to the string, *c*, draws back the lever, *b*, to its normal position, and the mill is in readiness for making another impression. To prevent this lever from passing beyond the required position, a pin is fixed in a slotted plate, *e*, which is arranged behind the lever, *b*, so that the mill is always brought back to the same position preparatory to its descent on to the roller for making another impression. In lieu of a cord and weight to bring back the lever, *b*, a helical spring may, if preferred, be used for the same purpose. In this way the elevating and descending motion of the mill is accomplished by self-acting mechanical means, so as to dispense with the manual attention for performing this part of the engraving process, thus effecting considerable economy as well as accuracy of workmanship, in a very superior manner.

TURBINE WATER-WHEELS.

(Illustrated by Plates 275 and 276).

THE old mode of obtaining motive power from streams of water by means of the ordinary cumbrous water-wheels, is fast being superseded by the cheaper, more compact, and more economical turbine water-wheels; and the time is not very distant when common water-wheels in our large manufactories will have entirely disappeared, and will be viewed in the same light as we now look upon one of Savery's or Newcomen's engines, as compared with our modern steam engines. The size of the turbine is so small compared with the ordinary water-wheel, particularly for the higher falls, in consequence of the water acting on all the buckets of the turbine wheel simultaneously, and flowing through the wheel with a velocity corresponding to the height of fall, which is, of course, very great for high falls; but in a common wheel the water only acts on a small portion of the circumference at a time. It will, therefore, easily be understood that the dimensions of the turbine wheels have only to be a fraction of those of common water-wheels under similar circumstances. The speed of common wheels is limited to ten or fifteen revolutions per minute; and some larger water-wheels make no more than three or four revolutions per minute; but with the turbines the speed is always much higher, and increases with the height of fall; for instance, a twenty horse-power turbine for a five feet fall will make about forty revolutions per minute (more or less, according to the system on which it is constructed); whilst a twenty horse-power turbine for a eighty feet fall will make about 1000 revolutions per minute.

The inventor of the first turbine of practical value was a French engineer, M. Fourneyron, and there are yet turbines of this description made; their construction is, however, complicated, and liable to derangement, and the working parts are very difficult of access. Many other turbines have since been invented and introduced, with more or less success. It is, however, only of late years that turbines have been introduced in this country. Our plates, 275 and 276, show two modifications of Schiele's patent turbine, as manufactured by the North Moor Foundry Company, Oldham, which may be considered to come nearer perfection than any other now in use, in point of simplicity of construction; and from practical trials, the manufacturers are prepared to guarantee them to be superior in point of economical working to any other kind of turbine water wheels.

On the Continent of Europe and in America, turbines have been so extensively introduced that they may be said to have completely superseded the old water-wheels, at least in all cases where economy and steadiness of action are main objects. They are equally well adapted for high and low falls. For high falls, where often very large water-wheels, and even several wheels placed one above the other are applied, they recommend themselves particularly by their cheapness, compactness, and economical working. For very low falls, where only under-shot water-wheels can be used, which give a very inferior percentage, the turbines are superior on account of their greater useful effect. Back-water, which is frequently such a great impediment with water-wheels, does not in the least impair the efficiency of the turbine as long as the height between the water-levels remains the same. Fig. 1, of Plate 275, is a side elevation of a horizontal turbine, with vertical shaft and the casing round the turbine shown in section. Fig. 2 is a plan of the same, corresponding to fig. 1, showing the casing of the turbine in horizontal section. Fig. 1, of Plate 276, is a side elevation of a vertical turbine with a horizontal shaft, and fig. 2 is a front elevation of the same at right angles to fig. 1. This turbine being shown as fixed against a wall at some distance above the bottom of the fall, that part of the fall below the turbine acts by the force of suction or vacuum, as hereafter explained. The water being conveyed *to and from* this turbine in pipes, it may be fixed in any position as most convenient, either to a wall, as shown, or on the ground floor, or to a beam of the roof. The pipes can, of course, be oblique, at any angle, to suit the locality.

The mode of working the turbine, as shown in figs. 1 and 2, Plate 275, will be easily understood from these engravings. The water is conducted to the turbine either in an open canal, or as is more generally the case, in a range of piping passing to the horizontal, spiral water-chamber, A, surrounding the wheel, from which it is guided through the water-ports, B, on to the middle of the wheel's circumference or periphery in such a direction as to enter the buckets or wings, C, of the wheel, D, without any shock; it gives its power off by a steady pressure while it is passing along the curved wings or buckets, after which it issues on *both* sides of the wheel, to the tail-race, quietly and silently—a clear proof that the whole of the power has been absorbed. In thus acting towards *both sides* of the wheel, the water exerts no pressure whatever on the footstep. The wheel is also cast hollow, and made air-tight, so that, being full of air, it is partly floated by the water; and by allowing a little more water to flow through the buckets on the upper half of the wheel than through those on the lower half, the water exerts more pressure upwards than downwards; and this quantity of water passing towards each side, can be so regulated that the surplus pressure upwards just balances the weight of the wheel and shaft, so that there is no pressure whatever exerted on the footstep. The footstep is made adjustable, and is constructed to Schieles' patent anti-friction curve (a description of which may be found in Nos. 15 and 43, Vols. ii. and iv. respectively, of our *Journal*), which is unsurpassed for the least possible wear and friction in footstep bearings. It will be seen from the plates that the construction of the turbine is as simple as can well be imagined; the wheel is quite free of access to all its parts, and can be lifted out without removing any other parts, in order to get at the foot-step. It is also not liable to touch, as in other turbines, by any wear of the footstep, as it can freely sink in the cylinder or water-chamber that surrounds it. It allows of a very minute economical adjustment for variable loads and variable quantities of water, either by hand or by governor. Our engravings show a method of regulation by hand. This consists of brass slides, E, which are shown in fig. 1, as moved by rods, F, and hand-wheels, G, by means of which any number of water-ports or guide-grooves can be closed successively, in proportion as the quantity of water at command, or the amount of load in the turbine decreases.

The quantity of water allowed to flow into any turbine should never be regulated by means of a sluice or throttle valve. As the water in it acts by momentum, its duty depends on the velocity with which it flows through the water-ports, B, on to the wheel, D. For if at a certain fall the water was partly shut off by a throttle-valve in the pipes, so that only half the quantity for which the turbine was made, was admitted, the velocity with which the water would pass through the water-ports would also be reduced to one-half the original velocity, and as the effect of the water is in proportion to the square of the velocity and to the quantity, thus, then, the effect obtained would only be one-eighth of the full power, though half the quantity of water is passing through the wheel. But when the flow of the water is regulated by shutting off the ports, B, with the slides, E, or 1, 2, 3, fig. 2, in succession, *the quantity of water passing is reduced, without reducing its speed*, so that half the quantity of water will give half the original power, and so on in proportion. This mode of regulation is of the greatest importance, where the water-supply or the load is very variable.

In the vertical arrangement of turbine, with horizontal shaft, shown in figs. 1 and 2, Plate 276, the water, as it leaves the wheel, on both sides, is collected in a chamber, *a*, enclosing the whole wheel, from which it is taken by the pipe, *b*, to the tail-race. In all other respects the action of this turbine is the same as that of the horizontal one already described, in reference to the several figures on the Plate, 275. If the tail race is below the turbine, there will be suction in the chamber which receives the water from the wheel, and this has exactly the same effect as pressure, so that the turbine can be placed, without any injury to its effect, at any height of the fall, not exceeding, however, 33 feet, above the tail-race, as the suction can never be more than that of a column of water equal to the pressure of the atmosphere, and any greater depth would therefore be lost.

This arrangement of turbine is particularly well adapted for high falls and moderate quantities of water. They require scarcely any foundation, and can in some cases be supported by the piping alone. They can be placed in the exact position where the power is wanted, the water being conducted to and from the turbine in pipes. All the working parts can be easily taken out without breaking any joints, or removing the outer casing.

The following are some of the main advantages claimed for these turbine water-wheels, compactness, cheapness, simplicity of construction, with economy of water, and working by the momentum of the water, quick speeds are easily obtained; while it can be made to work at different speeds, to suit the requirements, for various kinds of work, without much impairing the efficiency of the turbine. It is very free from all vibration and noise in working, so that the foundation needed is only that required to support the gearing. Town's water may be used for driving these turbines for domestic and other purposes, and it will be as good for use after passing the turbine, as before. By the following data any person may calculate the power in a fall of water:—

The "horse-power" of a water-fall is found by multiplying the quantity of water (in pounds) which falls in a minute, into the perpendicular height of the fall (in feet), and dividing the product by 33,000. The value of a horse-power amounts to 33,000 lbs., lifted one foot high in a minute; therefore, the working horse-power value of a water-fall consists in the quantity of water which comes from the top to the foot of the fall in one minute. Thus:—"What is the horse power of a fall of water 30 feet high, with one cubic foot flowing over it per second?" Answer:—$60 \times 62·5 \times 30 \div 33,000 = 3·40$ horse-power. From this, 25 per cent. should be deducted for friction, leakage, etc., leaving 2·55 as the actual power that may be obtained by a wheel. There are $62\frac{1}{2}$ lbs. of water in a cubic foot; 60 feet fall in a minute. This quantity (in pounds) is multiplied into the perpendicular height, and divided by the standard of a horse-power. But how can we find out the quantity of water which falls in a given time? It is impossible to measure it with a gallon or other standard vessel; is there not some simple method of finding this out? There *is* a simple method determined long ago by experiment to be sufficiently accurate for common purposes. For example,—If we take a vertical trough 30 feet high, and make a slit 24 inches long, by 6 inches wide in its bottom, how much water will flow out of it in a second, when it is kept constantly full? The following is the formula employed for ascertaining this:—$2 = \sqrt{30} \times 5·5\, a + 1,723$. That is, 2 is the quantity which falls per second; it is equal to the square root of the height multiplied by the co-efficient, 5·5, and the section, *a*, in inches (144) of the opening, divided by the number of inches in a cubic foot. This gives 2·5 cubic feet flowing through the opening per second. In accordance with the laws of gravity, the velocities are as the square roots of the heights or spaces through which a body falls. Therefore, as gravity produces the velocity of 2 in descending through a space of 1, the height (in feet) through which the body falls being multiplied by 64, will give the square of its velocity (in feet) per second. If the height fallen be 1 foot, the square root of 64 is 8, which is the velocity with which a heavy body falls through that space. The square root of 30 is 5·47, which is multiplied above by 5·5, instead of 8, because experiments have determined that when water flows through rectangular notches, there is a retardation of its velocity amounting to 2·5 of 8. By placing a notched beam or weir at the top of a fall, the same rule will enable any person to calculate the quantity of water flowing through it without much trouble or expense. This mode of gauging is fully described, and examples given, at page 123 of the "Practical Draughtsman." There may be persons who have high falls on side hills, with a small supply of water laid down by tubes. In such cases, small turbine wheels may be employed at but a little cost, to do a great deal of work, especially to a farmer or any country mechanic.

BOILER EXPLOSIONS.

VII.

Many different theories or opinions have been advanced as to the causes which produce the explosion of steam boilers, and, in the recent discussions of the question, it is to be regretted that there is an evident loss of temper, which has, for the present, apparently ended in vituperative explosions; but we have still the question to ask, What are the causes that produce boiler explosions? The different theories advanced appear to rest on probabilities, for we cannot yet affirm them to be facts. We think, reviewing the whole controversy, that there is one prominent feature, that is, the angry feeling that has been evinced, as to who was the first to advance what is termed the true theory; it appears we have much to learn before we can clearly understand the relations that subsist between heat, water, and steam.

In my last, I stated that I should have occasion to refer to magnetical indications. I have no theory to advance, but simply a few facts, which may be greatly extended by experimental observations, and it will thereafter be time enough to arrange them, and decide which theory rests on the soundest basis. There can be no doubt that we are far short of fundamental principles on which to base a true theory; for it is quite apparent from the controversy that what is claimed as being the true theory does not rest on clear fundamental principles, and besides this, there is no practical advantage in admitting probabilities till experimental facts have been fully discussed.

The magnetical indications were observed by the following arrangements. A magnetic needle was suspended by a silk fibre within the steam boiler B, fig. 1, p. 63; this needle was so suspended that its indications could be observed through the windows in the boiler. The needle in this way could be observed either within the water or steam space. My first observations were with the needle suspended in the water, the boiler being placed so that the windows were on the line of the magnetic meridian, from this the indications of the needle could be carefully observed. The instant the flame was applied to the organd lamp C, the needle began to oscillate on the polar meridian, and, as the heat increased, the north end of the needle began to move westerly, and when the pressure of steam rose to fifteen pounds, it assumed pretty nearly an easterly and westerly direction, and continued to oscillate in a similar way, as on the magnetic meridian. When a 12 inch magnet was applied, at a short distance from the boiler, for the purpose of bringing back the needle to the magnetic meridian, the needle appeared to be indefinite to position. This experiment I often repeated in the presence of others, and always with similar results. I have applied the flame in different ways, so that these indications were not produced by the bursting of the water bulbs on the surface. Thus showing that the atomic condition of the water had undergone a change when subjected to heat or pressure, the atoms forming in a transverse direction to that of the polar.

My next observations were with the needle in the steam space. In this way it continued to oscillate in the magnetic meridian, thus shewing the vapoury condition to be under the polar influence instead of the equatorial. From this it seems evident that the atoms, in the combined form of water, have a different polar arrangement from what they have in the vapour condition. These indications direct us to compare those observations with other polar indications. It would appear that the water, under those conditions of energy, is under a strong diamagnetic force, and, it will be observed, this diamagnetic condition is induced as the pressure or temperature increases. There can be little doubt but these conditions arise from the specific arrangement of the atomic mass.

A helix was formed of covered copper wire, and was made to slip on to the centre of the boiler B, the ends of the wire were then connected with the poles of a small battery; with this arrangement, the magnet became quite indefinite to position, and the ebulition of the water seemed to be much increased, giving indications of a disturbed condition. I did not venture to try the effects of a powerful battery, as my observations were made with the apparatus fixed on the parlour table. I intend to experiment further in this direction, the results of which I will communicate.

My next observations were to endeavour to form some idea of the dynamical effects produced by mixing the water and steam, or what is termed boiling over or priming. A barometer gauge was attached to the stop cock, F, similar to the arrangement shown in the *Journal* for March last, p. 10, fig. 8, when the stop-cock, G, was opened at a pressure of 30 pounds, the water immediately filled the steam space, and the gauge began to fall. I carefully observed the gauge the instant I closed the cock—a very slight reaction was indicated, but not at all what might be inferred from theoretical reasoning. There was a considerable difference in the time of its rising, which was due to the bottom of the boiler becoming much hotter during the time the water filled the steam space, and thus evaporating the water much more rapidly, until it arrived at its original pressure. What the effect might be with superheated steam, I will not offer any decided opinion, but am not inclined to think from the foregoing experiments, that the explosion of boilers arises from a mixture of steam and water, and that we must look for the cause in some other direction.

It has been said by one writer, in discussing this question, that the electrical theory has been almost entirely abandoned. He may have good reasons for making such a statement; but if he has, he might have condescended to enlighten his numerous readers on the defects of the electric theory in its relations to boiler explosions, as the different theories advanced seem to be far from being satisfactory, when we test them by practical experiments, however well they may look in theory. This we may infer from the evidence recently adduced in the American Court, in a trial for the recovery of damages for injuries done by the bursting of a boiler—the theories advanced on both sides were anything but satisfactory, and the theory advanced at home seems little better. It may be as well that we again examine the electric hypothenosis of the question, and see what evidence it presents, and how far its indications may assist our views of the question.

The electrical condition of the water being negative, and that of the steam being positive, as the pressure increases the water apparently passes into a diamagnetic condition; and as we know that by heat, pressure, or strain, we may change the magnetical condition of bodies, and that the magnetism of iron may be much increased by heat, strain, or pressure, when in certain positions, it follows there would be no straining of the mind to suppose any of those conditions of force to have undergone a change, and that change to produce disastrous consequences. There are certain constructions of boilers which may be more favourable for inducing or repelling the magnetical forces—for we know that the polarity of iron runs much stronger in the line of its reed or grain than if it was induced in a transverse direction. I do not at present propose to lay down any principles for the constructing of boilers, but I think that wherever the unfortunate occurrence of an explosion takes place, the arrangement of the plates ought to be carefully observed as to the direction of their grain or reed being parallel or transverse, more particularly the ruptured plate and those around it. If a little attention was given to this point, we might arrive at sounder deductions as to whether the magnetic forces had anything to do with the catastrophe.

It will be apparent that the different theories advanced do not offer any further security of life and property; and we ought not to rest satisfied until we have a much better solution of the question than what has been advanced can give, for we should not be satisfied when told that such and such is the only rationale—we must not be content to rest on theory, but on facts.

It appears from the evidence adduced in the American Court that the boiler which had exploded was of an upright construction, having a cast-iron top or cover. If the reed or grain of the plates which formed this boiler, ran upwards, as the heat of the boiler increased the magnetic condition would increase in proportion; and I am inclined to think that a cast metal cover would not be the best arrangement for conducting the magnetism from it; besides the boiler in this condition would itself form a powerful magnet. I am inclined to believe from observation and experiments, that evaporation goes on more freely in a boiler under magnetical influence, whether natural or artificial, than if its condition was reversed. I have seen boilers constructed in such a way that I knew well that their magnetical condition would be very different under intense heat. There is another point which seems to favour the magnetical view of the question, that is, that in the case of boilers which have been examined after bursting, it was observed that the fracture did not take place at the weakest point. This may be readily accounted for on magnetical principles, but I do not see that we can well explain it upon any other grounds.

Paul Cameron.

RECENT PATENTS.

PAPER MACHINERY.

Edward Gardner, *Maidstone, Kent*—*Patent dated* 8*th Oct.*, 1860.

The patentee's improvements consist of a new arrangement of the "Knotter" for straining the pulp used in the manufacture of paper, and in the employment of a vessel or vat, in the interior of which is a strainer, the perforated or straining surfaces of which are in a vertical or nearly vertical position. These straining surfaces are combined with closed ends, so as to form a hollow receptacle with perforated or slotted sides, as represented in the annexed engravings.

Fig. 1.

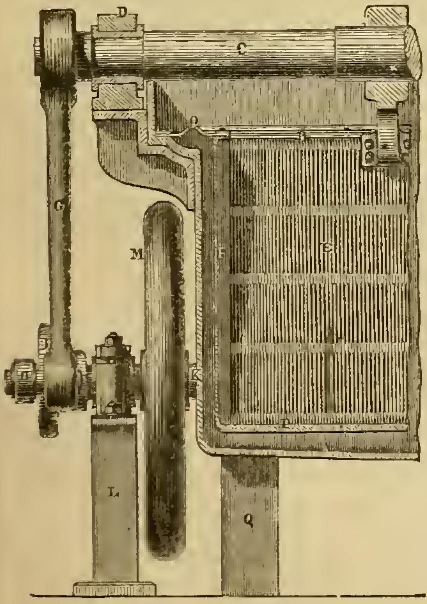
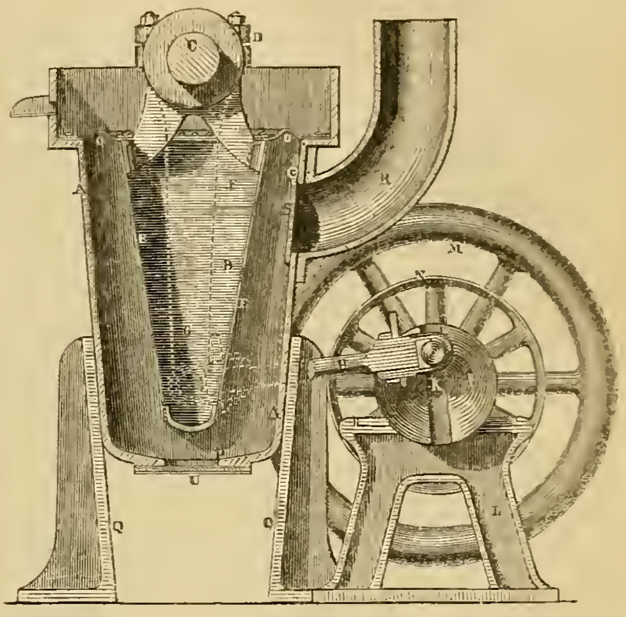


Fig. 1 is a longitudinal vertical section of the improved "Knotter." Fig. 2 is a corresponding end elevation of the same, showing the "Knotter" in section. A is a stationary vessel or vat, and B the vibrating or oscillating strainer connected to the overhead rocking shaft, C, working in bearings, D, secured to the ends of the vat, A. E is one of the perforated or open-work sides of the vibrating strainer, and F is one of the closed ends of the strainer which unite the two open sides, and form a rectangular box or receptacle. A rocking motion is imparted to the shaft, C, by means of the lever arm, G, connecting rod, H, and slotted disc and crank pin, I, disposed at each end of the apparatus. The two discs, I, I, are carried by the driving shaft, K, working in suitable bearings carried by the standard, L, and provided with a fly wheel, M, a rotatory motion being imparted to this shaft by means of a strap passing over a driving pulley. On the other end of the driving shaft, K, is an India rubber or other flexible diaphragm which connects the edge of the vibrating strainer with the edge of the stationary vat, and prevents all communication between the two, excepting through the perforated sides of the strainer. P is the bottom of the strainer, which is formed with flanges to which the perforated sides are secured. The outer vat or vessel, A, is supported on standards, Q. The pulp to be strained is fed into the vat, A, through the pipes, R, each pipe being supplied with a self-closing flap valve, S, for checking the backward motion of the pulp in the pipes when the strainer vibrates towards them. The strained pulp passes through the perforated or open-work sides of the strainer, and flows over the edge thereof by the overflow spout, to the paper-making machine. An aperture in the bottom of the vat, A, is provided with a hinged or other suitable lid or cover, packed with India-rubber to facilitate the emptying of the vat when required. Two large holes are made in each end of the vat, A, for the purpose of enabling the perforated or open-work sides to be cleared of knots or obstructions adhering thereto.

Fig. 2



BLAST FURNACES.

J. H. Johnson, *London and Glasgow*.—(Adrien Muller, *Paris, and* Alex. Lencauchez, *Besancon*).—*Patent dated* 31*st August*, 1860.

Under this specification is described a peculiar system or mode of treating various ores, whether containing zinc or non-volatile metals, and to certain peculiar constructions and arrangements of apparatus employed in such treatment.

The hearth and tuyeres of this blast furnace may be constructed and arranged in the ordinary manner, but the boshes are less expanded and higher than usual. The outlets for the gas and vapour are disposed at the belly of the furnace, and open into an annular flue or chamber, which encircles the lower part of the body of the furnace. This flue communicates through a passage with the condensing chambers, for the reception of the vapours of zinc. These chambers communicate with each other by means of openings made alternately in the upper and lower portions of their several division walls, in order to obtain as long a circuit for the gases and vapours through the condensing chambers as possible, and to render the process of condensation more regular. The first of these chambers is provided with a conical closing hopper, for the introduction of what is known as zinc "fume," or finely divided zinc. The hearth or floor, which is common to all the chambers, is slightly inclined, in order that the condensed zinc may flow freely down it, apertures being left for that purpose at the foot of each division-wall. The roof of the four last chambers is composed of a galvanized iron water-tank, which, being kept constantly supplied with cold water, serves as a refrigerator, and greatly expedites the condensation of any remaining vapours of zinc. Large depositing chambers are placed in communication with the condensing chambers, wherein the current of the gases being considerably retarded, the fume which has been carried along by the gases is allowed to deposit. Two sets of depositing chambers are employed, and the gases are directed into them alternately, thereby affording facility for their being cleaned out occasionally. Each depositing chamber is provided with a washer, in which a descending shower or stream of water acts upon the gases which enter therein from the next chamber, and leaving the vapours of zinc to pass off into suitable apparatus, to be used as fuel in the furnace. The zinc thus obtained flows off by a channel. The interior of the furnace, for a distance of two or three yards above the belly, is built of fire-clay lumps, and the remainder, as far as the mouth, is composed of cast-iron, made in short lengths or frustums, jointed together. This part of the furnace is concentric with the outer brickwork, which rests upon the hollow crown. This crown is suitably hollowed out to receive the gas burners which are united to it by double elbow pipes, which connect the interior of the crown with the gas distributors, the whole forming an effective gas consuming apparatus. Upon the platform, at the mouth of the furnace, are erected four ovens for heating the fuel and mineral, by the aid of the gases which pass off from the furnace. The charge is introduced into the furnace through a cylindro-conical hopper, provided with a double bottom of a similar shape. This arrangement affords facility for introducing a charge without permitting the gases to escape. At about two-thirds the height of the furnace is fitted a small pipe, which admits a certain quantity of the gas which escapes from the condensing chambers, so as to cause the gases or vapours arising from the charges to descend, and thereby check all upward draughts or currents. The blast furnace is supplied with hot air from a tubular air-heating apparatus, which is itself heated by the combustible gases escaping from the condensing and depositing chambers. The furnace charge is made up into the form of blocks, dried as above described, these blocks being composed of—1st, The ore to be reduced; 2d, The proper quantity of wood, charcoal, or other combustible, necessary for the reduction of such ore; and, 3d, A sufficient quantity of lime to form a good cinder. The reduction of the ore in the furnace being thus accomplished by the contact with the carbon, the carbonic oxide gas will be unnecessary for this operation. The quick lime will combine with the gangue of the ore, to form the various silicates; thus by the use of these blocks of ore, fuel and lime combined together, the transformation of carbonic oxide into carbonic acid, and the disengagement of carbonic acid, which always results from the use of castine or flux, are prevented. By this system, therefore, a gaseous current, completely free from carbonic acid gas, is obtained, whilst a considerable temperature is maintained in the furnace. It may be observed in conclusion, that when the metallic zinc descends into the ordinary zone of the furnace, or when the oxide is carried along by a gaseous current, which amounts to the same, the current or draught produced by the combustion carries along with it considerable quantities of oxide. If the current traverses over or through masses of incandescent fuel, whether coke or wood charcoal, the particles of oxide carried along with it are almost immediately transformed into metallic vapour, by parting with their oxygen, which in this case performs the functions of a reducer. The wood-charcoal, by reason of its great porosity, has this property in a high degree. Various arrangements of apparatus may be employed for the attainment of the end in view, which is to cause the products of combustion and vapours of zinc to pass over or through as large a surface as possible of incandescent fuel, in order that should such products of combustion and vapours of zinc carry along with them any unreduced particles, these particles will undergo reduction during their passage through or over the incandescent fuel.

WASHING MACHINES.

J. H. Johnson, *London and Glasgow* (Josef Johnson *and* Elliot Dickerman, *New York*).—*Patent dated 24th Sept.*, 1860.

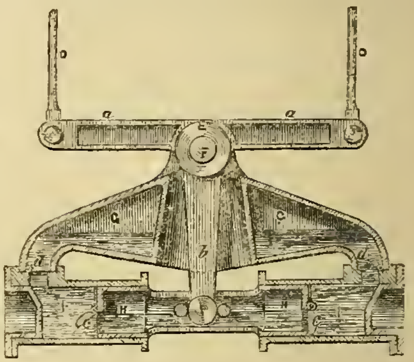
These improvements relate to the arrangement of machinery or apparatus for washing and wringing clothes and similar articles. These operations may be either combined in one machine, or used separately, as desired. According to one part of this invention for the washing of clothes and similar articles, a roughened-faced revolving disc in combination with a roughened wash-board, such disc and wash-board being mounted parallel to each other, and placed in a vertical or nearly vertical position. The disc and wash-board are contained in a suitable wash tub or vessel, half-filled with water, so that the disc is only partially immersed therein. A rotatory motion is imparted to the disc by a winch-handle, and the clothes to be washed are placed between its roughened face and the roughened surface of the wash-board. When the disc is mounted on a horizontal axis, it is pressed against the clothes by a helical spring or other suitable contrivance; but when the axis is inclined downwards, the gravity of the disc is sufficient to impart the requisite pressure to the articles to be washed. The operation of washing is effected by rotating the disc, which causes the clothes to roll in a mass over the surface of the wash-board, alternately leaving and entering the water as they are carried round. This alternate immersion of the clothes, and removal from the water, combined with the pressure of the disc, has the effect of alternately saturating them, and expelling the water or washing beyond them from, without the injurious rubbing of the fabric so objectionable in most washing machines. An improved wringing machine is also included, and consists of a pair of india-rubber or other elastic rollers, backed by one or more rigid rollers. The axes of the elastic rollers are allowed to rise and fall freely in the standards of the machine, so as to enable the elastic rollers to adjust themselves to the thickness of clothes passed through them. These rollers are tightened up or compressed, by screw spindles acting upon the bearings of the upper or rigid rollers, and the whole is so made as to be readily and simply applied to the side of the improved or other washing machine, or to the edge of any ordinary wash-tub.

PUMPS.

George P. Dodge, *London*.—*Patent dated 30th August*, 1860.

In the specification of these letters patent is described a new arrangement of pumps, for forcing water from wells or other sources, lower than the place where the motive-power can be conveniently applied, and a peculiar arrangement of apparatus or mechanism for working such pumps.

The subjoined engraving represents a vertical sectional view of one arrangement of the improved pump, and part of the actuating mechanism and air chamber—the actuating mechanism being only partly shown. An actuating lever, overhead handle, which may be of any convenient construction, is pivotted or wrought on a centre; and at equal distances on each side of this working centre are connected in any suitable manner the two rods, D D. The lower ends of these rods are also connected to the extremities of the horizontal arms, *a a*, of the T shaped lever, E, which vibrates on a fixed centre, at F, on the top of the air-vessel or chamber, G. An opening is made in the centre of this chamber, to admit of the free working therein of the vertical arm, *b*, of the T lever shown in the engraving) which arm is connected at its lower end, with the double pistons, H, H, the intermediate portion between the pistons being left open so as to admit of the water entering behind and passing through each piston into the respective pump barrels, I I, alternately, during the to and-fro motion of the pistons. These pistons require no packing; but they are each provided with a valve, *c*, opening inwards to the barrel, so that the water may pass through the open valve, and fill the barrel when the piston is moving outwards, and be expelled again through the valve, *d*, into the air-vessel or chamber, G, at the return stroke of the piston, the valve, *c*, being at that time closed. It is thus obvious, that as one barrel is filling, the other is simultaneously emptying, so that with the aid of the air-vessel, G, a perfectly continuous stream or jet of water is obtained. The air-vessel or chamber, G, opens into the lower end of a metal pipe, to which may be coupled a hose-pipe, if the pump be required as a fire-engine; when used simply as a water elevator, the hose-pipe and nozzle may of course be dispensed with.



HOISTING AND WEIGHING APPARATUS.

J. H. Johnson, *London and Glasgow* (Louis Vernay, *Paris*).—*Patent dated 14th September*, 1860.

Under these letters patent, various constructions and arrangements of apparatus for raising or lowering heavy goods in warehouses, a weighing machine is included, and it consists in the employment of a vertical framing or standard, fitted upon a bed-plate, which carries the hoisting mechanism and over-head pulley for the hoisting chain to pass over. The lower portion of this framing or standard is fixed to the bed-plate, and the upper portion is hinged to the lower portion, so as to be capable of being turned down towards the bed-plate, or connected with the lower portion by a rack and pinion, which admits of its being slid up or down, as required. The object of lowering the upper part of the standard is for the convenience of the apparatus being passed through a doorway. Set pins or bolts are employed to fix the upper portion in an elevated position, or a ratchet wheel and detent, in connection with the elevating pinion, are employed, when a rack is used. The bed-plate is provided with travelling wheels, to enable the whole to be easily transported from place to place; and these wheels are made removeable, so that when the hoist is working the bed-plate may lie firmly upon the ground. A weighing platform is also fitted to the bed-plate, so that the goods, before being raised, are by this means weighed. The goods can then be received on a swivel, or pivotting truck, in which they are elevated, and when elevated the truck is then turned round on its pivot, so as to facilitate the removal of the same, which can be run off on to rails or trams, provided for that purpose. In lieu of a truck the raising table, which elevates the goods, is made to swing round in either direction, being connected for that purpose to a vertical pivot, on one side. When the table is dispensed with, hook and chain tackle are employed, and are suspended from an overhead swivel bracket, provided with a rod and counterweight, for swinging the same. When the application is constructed with the upper part of the standard, hinged to the lower, it can be employed generally in all cases for raising and lowering goods from or to a lower level, as for example, in the discharging of ships' cargoes, and in loading ships, for which application the upper parts of the standard are constructed, taken down to a horizontal position, and supported by a tressle, or lowered until it bears upon the bed-plate itself.

The standards of these hoists are made either open in the centre, that is consisting of two side frames, united at the top, or merely composed of a single bar or vertical post, in which latter case the iron is made either of a V section or of a tubular form, whereby great strength, with lightness, are combined, so that the machines are easily and quickly transported from place to place, and the raising and lowering of the goods safely effected.

MEASURING LIQUIDS.

J. H. Johnson, *London and Glasgow* (Augustin M. Herland, *Paris*)—*Patent dated 22d October*, 1860.

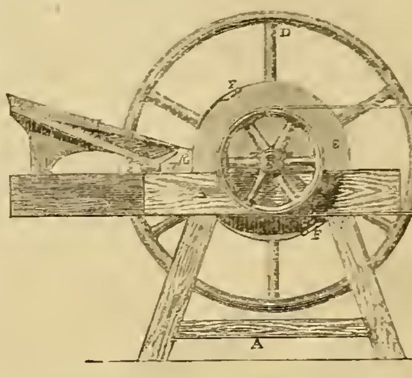
The improvements specified under these letters patent, relate to a peculiar construction and arrangement of apparatus, whereby the flow or amount of consumption of liquids is indicated in a simple and efficient manner, and consists, as applied to a service or house cistern, in so combining the feed or supply-pipe of the cistern with the discharge cock or pipe, that the opening of the one will effect the simultaneous closing of the other, and *vice versa*, the level of the water in the cistern being by this means made to fall when the water is drawn off therefrom, and to rise again when the feed or supply is turned on; but in no case can the water be drawn off simultaneously with the inlet or supply of fresh water to the cistern. This peculiar combination of the feed-pipe with the discharge-pipe is effected by means of a cock, with the body or shell of which both pipes open, but the plug of which is provided with corresponding apertures, or with a groove or channel so disposed that the opening of one orifice in the body of the cock will close the other, and *vice versa*. The consequent alternate rising and falling of the level of the water in the cistern is made to impart a rotatory motion to the spindle of a counter, by the agency of a float inside the cistern and a counter weight outside the float, and counter weight being suspended from cords or chains, which pass each over a pulley on the spindle above referred to. The pulley of the float is loose upon the spindle, but when it rotates in one direction, it imparts a rotatory motion to the spindle by a system of palls and a ratchet wheel, without influencing it, and consequently without actuating the counting mechanism, which is made of any convenient construction. The palls and ratchet are so arranged as to come into action during the descent of the float, thereby showing the amount of liquid drawn off from the cistern or during the ascent of the float, so as to show the amount of liquid supplied to the cistern. The support of the float is made conical, so that when the cistern is nearly full, it fits closely into an air hole or vent in the lid or corner, and by thus precluding the escape of the air, prevent the further influx of water therein, and overflowing of the cistern. In order to prevent any derangement of the apparatus by the freezing of the water in the cistern, it is proposed to form a separate chamber or compartment in the bottom or sides of the cistern, which is kept supplied with warm water by pipes for that purpose. This arrangement is obviously applicable to all house or service cisterns, when the water therein is liable to become frozen in inclement weather.

SLATE-DRESSING MACHINES.

John W. Greaves, *Port-Madoc, Carnarvon.—Patent dated 3d Oct.*, 1860.

The preparation of slate, for various useful purposes, occupies a large amount of labour in several parts of Wales. Mr J. W. Greaves has devoted his attention to the means of facilitating the preparation of this useful mineral. His improvements consist of a peculiar arrangement and construction of machinery, or apparatus for dressing or trimming the edges of slates and slate slabs, intended for roofing and other purposes, and consists in the employment, for that purpose, of a set of revolving knives or cutters, placed obliquely in a frame, in conjunction with a fixed cutting edge and table, upon which the slate to be dressed is laid, suitable means being employed for simultaneously gauging the various sizes of slates.

The accompanying engraving represents a side elevation of the improved slate dressing machine. A is the main framing or support of the machine, and B the cutter shaft, rotating in bearings fixed to the main framing, and driven either by a strap and driving-pulley, C, or by a treadle movement, winch-handle, or other suitable mechanical contrivance. This shaft, B, has keyed on to it a fly-wheel, D, and two wheels or discs, E E. To the peripheries of these discs, E, are bolted, or otherwise secured, the dressing knives, F F, which are placed at a slight angle to the shaft, B, or separately, as may be required, by which arrangement they operate progressively upon the slate from end to end. G is a stationary knife, secured to the main framing, and placed so as to be parallel to the shaft, B. A gauge, H, is fixed to the main framing, and serves to gauge the different sizes of slates and slate slabs, whilst being cut or dressed. The slate to be dressed is laid with one edge flat upon the fixed knife, G, whilst its other edge rests upon the gauge, as shown at *g*, in the engraving. The knives, F F, as they rotate, dress off the edge of the slate, which protrudes beyond the fixed knife, G.



SAWING MACHINES.

Griffith Owen, *Merioneth.—Patent dated 18th September*, 1860.

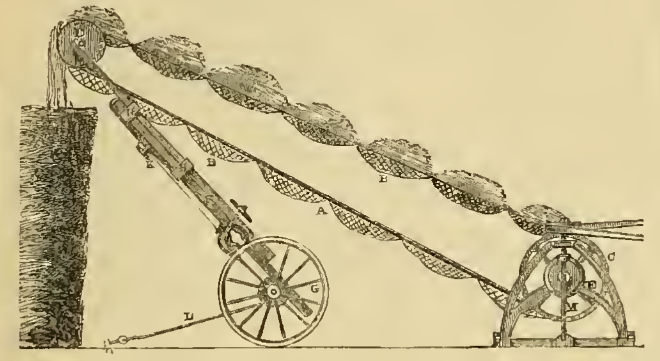
Mr Owen's improvements comprehend a particular arrangement and construction of machinery or apparatus for sawing stone, slate, slabs, iron, and other hard substances. The middle part of the bed of the machine is composed of cast-iron, supported upon standards, having the remaining parts of the bed also constructed of cast-iron, bolted thereto, and carrying a series of anti-friction rollers or pulleys, upon, and over which, the platform or table traverses when feeding the material up to the saw, and returning again for a fresh load. The periphery of the circular saw flanges may be serrated or otherwise, according to the nature of the substance to be operated upon, and is fixed into the end of a spindle, working in suitable bearings in the bed. This spindle is driven by a belt and driving pulleys, in the usual manner, and carries one, two, or more eccentrics, which actuate palls, each pall being formed with an ordinary eccentric ring, which fits easily around the periphery of its corresponding eccentric, consequently on rotating the saw spindle the eccentrics will impart a vibrating or to-and-fro longitudinal motion to the two palls. These palls take into the teeth of a ratchet wheel, carried by another shaft, which also carries the feed-roller, and cause that wheel and roller to rotate. The eccentrics are so disposed that one pall is in full action whilst the other is being drawn back, preparatory to making another stroke, and consequently the motion of the ratchet wheel is continuous, as one or other of the palls is always in action. When the eccentrics are made to slide along the saw-spindle and two or more ratchet wheels of different sizes, fitted side by side on the driving shaft, the speed of the feed motion can be regulated at pleasure, by causing the palls to operate upon a larger or smaller wheel. The ratchet wheels are fitted loosely upon the driving shaft, and are brought into gear therewith during the time the feed motion is required, by means of a clutch box and lever-handle. On the outer end of the driving-shaft is fitted a spur-wheel and clutch-box, the former gearing into the pinion, keyed fast on the saw-spindle. When the platform or table is to be run back, the one clutch is thrown out of gear whilst the other clutch is thrown into gear by means of a handle, when the driving shaft and feed roller (the latter carrying the ordinary feed chain), are reversed, and the table is run back with a quick motion to its original position. The positions of the clutches are now changed, so as to bring the former clutch into gear, and the latter clutch out of gear, when the slow feed-motion through the palls and ratchet-wheels will recommence.

STRAW-STACKING MACHINE.

William Wilkinson & Henry T. Wright, *Boston, Lincoln.—Patent dated* 10*th September*, 1860.

This improved apparatus, which is used when stacking straw and other agricultural produce, consists in the employment of two or more endless chains or ropes distended over two rollers somewhat resembling a common elevator, or endless chain of a dredging machine.

The annexed engraving represents a side elevation of the complete machine at work. A is the endless band, which is so constructed as to admit of being shortened or lengthened by having moveable sections, to be removed or added, as the case may be. This endless band is composed of two endless wire or other ropes; and these endless ropes carry a series of flexible pockets or concave receivers, B, which are made of strong netting, though other flexible fabric or material may be used in place thereof. This endless band of flexible concave carriers is kept extended when in use by means of two rollers, C and D. The axes of the lower roller are carried by bearings in a frame, F, or by a frame attached to a thrashing machine. The upper roller is carried by and turns on the bar which connects the poles, F, together, the lower ends of such poles is carried by two wheels, G. These two poles consist of two or more parts, so as to admit of their being contracted and extended in length, and are combined by two straps, H, fixed to the bar, I. The upper part of these poles is caused to slide by means of a wire, rope, cord, or strap, which at one end is fixed to the lower end of the upper part of the pole, and its other end is fixed to the roller, J, which receives motion by a screw and worm-wheel on the axis of the roller, J. The two parts of each pole are retained from sliding by a set screw, K, which passes through the bar, I. The wheels which carry the poles are retained in any desired position by chocks or wedges placed behind them, or they may be held to the ground by a cord or chain, L. The endless band is put in motion through the axle, M, by means of a band driven from a threshing machine or other source. This axle, by means of a bevel pinion, gives motion to the bevel wheel on the axis of the roller or drum, *c*. This continuous chain of flexible pockets or receivers, in succession, become flattened as they pass over the upper roller, and are consequently turned, as it were, inside out; they then pass down again to be refilled.



RAILWAYS.

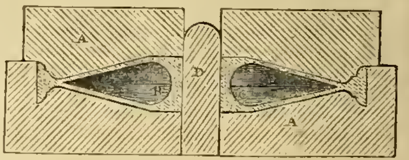
J. H. Johnson, *London and Glasgow* (William Wharton, *Philadelphia*). —*Patent dated 8th October*, 1860.

A peculiar arrangement of railways, or tramways, is described in the specification of these letters patent, and the carriage-wheels running thereon, renders the carriages self-transferring from the main line on to a siding or branch, without the necessity of using switches or moveable points. The points, or those parts of the way where a siding or branch runs out of the main line, are made in such a manner as to remain always open, whether for the through traffic on the main line, or for the branch traffic; and in conjunction with these permanently open and fixed points is laid a guide rail, so disposed that by imparting a lateral thrust to the wheels of the carriage intended to be transferred to the siding or branch, those wheels are by this means caused to leave the main line and enter the branch line. These wheels on the carriage, to be transferred, and which are on the side of the line next to the guide-rail, are made of a greater width than usual, so that as they pass the guide-rail—which stands up higher than the ordinary rail—they are forced or pushed by it laterally into the branch, the flanges of the wheels passing through the open points. The guide-rails are placed either inside or outside of the line of rails, and the wheels acted upon by them have annular projections or reins formed upon them; or instead of this plan, special wheels for the guide-rails to act upon, serve the same purpose. Those carriages which are not required to leave the main line, are provided with the ordinary railway wheel, and consequently they are not acted upon by the guide-rails, so that they pass the points without leaving the main line.

FORGING MACHINERY.

J. H. Johnson, *London and Glasgow* (H. Petin Gaudet & Co., *Paris.*)—*Patent dated 27th September*, 1860.

The peculiar system or mode of shaping metals by forging and rolling, specified under these letters patent, is advantageously employed in the manufacture of railway wheels and axles, buffer heads, door hinges, the frames or holders for break locks, break levers, guard plates, shovels, spades, trowels, scythes, and in general all articles of a symmetrical form. According to this invention, suitably constructed rolls are used, according to the shape of the article to be produced, which rolls have a progressive alternating motion imparted to them in lieu of a continuous rotatory motion, as heretofore. This progressive alternating motion is derived from a vibrating lever keyed on to a rocking shaft, which also carries a large spur wheel for transmitting its motion to the gearing of the rolls. The vibrating lever is actuated by a rotating crank and connecting rod, and the gradual progressive motion of the rolls is obtained by increasing gradually the throw or stroke of the vibrating lever. This is accomplished by connecting the end of the connecting rod to a nut working on a screw spindle, which extends along the lever, and which is rotated a certain amount at each stroke by a pair of bevel wheels and a reversing pall and spur wheel, the direction of rotation of the screw depending upon the position of the pall. As the nut travels towards or from the free end of the lever it follows that the stroke of such lever will be gradually diminished or increased, the lever being thereby vertically lengthened or shortened; and this variation of motion is imparted in a proportionate degree to the rolls, which receive a partial circular reciprocating motion on their axles, but which motion gradually increases in extent at each stroke.



In applying this system of rolling to the manufacture of a solid railway wheel, for example, that is to say, a wheel made without arms or spokes, two halves of a wheel in the shape of two discs are first prepared; these are heated at the centre or boss, and are placed together in a matrix, A, as shown in the accompanying engraving, and welded together at the line of junction, B C, by the blows of a steam hammer. In this matrix is fitted a mandrel, which is cylindrical at the part, D, corresponding to the interior of the nave or boss, slightly tapered at the upper end above the nave, and conical also at the part where it is fixed into the matrix, in which it is retained by a key at its lower end, this key being withdrawn, so as to allow the mandrel to drop out when the wheel is to be removed from the matrix. The two discs being thus welded together, they are allowed to cool, and the rim is then applied. This is effected in the following manner:—The rim, E, consists of a wrought-iron ring, which, when heated to a welding heat, is placed in the matrix, and the wheel adjusted thereon. A few blows of the hammer welds the rim on to the periphery of the wheel, and simultaneously shapes the upper side of the rim similar to the lower side, the upper die or matrix being suitably formed for that purpose, as shown in the engraving.

If preferred, the two portions of the wheel may be welded together at the same time that the rim is formed, the rim forming a part of the discs themselves. Or the two halves may be made after the central boss has been welded, the edges of the discs being secured together by rivets, and the rim, E, secured also by rivets. Or the edges of the two discs can be riveted on to the rim, E, in which case this rim is rolled to the desired section.

In describing the method adopted for making the discs before referred to as forming the two halves or sides of the wheel, a circular blank is formed by means of a steam hammer and matrix or otherwise. This blank is heated and passed between the rolls, such rolls being gradually approximated until the blank is reduced to a thickness, say, of about half an inch, care being taken to change the direction of the rolling by rotating the blank partially after each passage through the rolls, in order to preserve its circular form. These blanks are then cut to a perfect circle, and are shaped or dished and provided with central bosses by means of suitable dies and matrices. This peculiar system or mode of rolling discs constitutes the essential feature of novelty in the manufacture of railway and other disc wheels. Of the rolls so employed one is perfectly plain and cylindrical, whilst the other has a channel or sunk portion in its centre, the centre of which corresponds to the outline or contour of the raised boss in the centre of the blank. This blank, in order to attain its proper thickness, is passed several times through the rolls, which are brought nearer together at each passage, the blank being turned about one-eighth of a revolution if it is intended to pass it eight times through the rolls, or one-tenth if ten passes are required, the object being to roll out the disc evenly in all directions, and so preserve its circular outline. But it will be readily perceived that the sides of the channel which forms the boss will leave corresponding marks; on the inner surface of the blank, a fresh mark or ridge being formed at each passage and change of position of the blank, forming in the end a number of radiating ribs corresponding in number to the number of times the blank has been passed through the rolls, and therefore it would necessitate an infinity of passes before a plain and even surface could be obtained. Further, it is hardly possible to present the blank to the rolls, so that its boss shall correspond exactly to the channel or groove, and it is also almost impossible to turn the blank each time the same distance. The internal face therefore of the blank and of the boss would consequently present an irregular appearance. The rolling apparatus has been therefore modified, so as to overcome these objections and enable a variety of articles to be constructed on the above-mentioned principles. These rolls in place of rotating in most cases reciprocate, but with a progressive motion. The lower roll is provided with a rectangular groove or channel, in which is inserted an iron or steel bar, which must exactly fit the groove. Near the longitudinal centre of the bar is a recess or matrix, the form of which corresponds exactly with the exterior form of the nave or boss on one half of the wheel. In the centre of this matrix there is a mandrel which is to be introduced into the aperture in the boss. The upper roll is plain, since the external surface of the disc is intended to be plain and smooth. The bar before-mentioned is supported on either side of the lower roll, by two supplementary rollers, the diameters of which are the same as the diameter of the lower roll, at the bottom of the groove or channel. This roll receives its motion from a large spur wheel fixed on the shaft, which also carries a lever arm; the wheel gears into the pinion keyed on to the axis of the lower roll, and itself gearing into a second pinion keyed on to the axis of the upper roll. The opposite end of the axis of this last named roll carries a second spur wheel, which transmits motion to two pinions, keyed upon the respective axis of the supplementary rollers. The diameters of the several wheels are so calculated as to impart the desired speed to the different rolls of the rolling mill. The shaft of the large wheel receives the alternating progressive motion, above referred to, from any convenient prime mover in the following manner:—The lever on the end of the lower roll shaft receives its movement from a rotating crank through a connecting rod, one end of which is forked and embraces a nut, within which works a screw spindle rotating in suitable bearings at each end. One of these bearings is formed by the point of a set screw, which may be tightened up to any extent required. The screw spindle carries near its lower extremity a bevel wheel keyed thereon, and gearing into a corresponding bevel wheel keyed on to a horizontal shaft, turning in a bearing in the plummer block. On this same shaft is also fitted a spur wheel, which acts as a ratchet wheel, and into the teeth of which are engaged the ends of a pall. According as one or other of the teeth of the pall is in gear with the wheel the screw spindle will revolve either to the right or left, and consequently the nut will rise or descend, thereby vertically lengthening or shortening the main lever, and diminishing or increasing the amount of motion of the wheel, and through it that of the rolls and supplementary rollers. In all cases the radius of the lever is greater than that of the actuating crank, so that it never assumes a position in a direct line with its actuating connecting rod, or in other words, will never reach the dead centre; and as it is requisite occasionally to impart a considerable amount of motion to the rolls, it is necessary that the wheel keyed on to the axis of the main lever should be of a larger diameter than those keyed on to the shafts of the upper and lower rolls. Instead of the screw and nut for lengthening and shortening the main lever, a rack and pinion serves the same purpose.

It is obvious that a square, octagonal, or other shaped axle may be produced by simply substituting rolls having grooves of a suitable form; and, indeed, the same principle may be carried out in the manufacture of various articles, some of which have been before enumerated as examples, by employing rolling and shaping surfaces adapted to produce the article required. In rolling an axle it is nipped first at its centre, at which part it should be about the same diameter as the grooves, so that the rolls will not require to be further approximated. Motion is now imparted to the rolls, such motion being very slight at first, and gradually increasing until the full throw is attained, when the axle has been rolled out to its proper length. If it be desired that the axle at the point where it is first nipped between the rolls should not correspond to the exact shape of the grooves, it may be flattened slightly, so that its breadth will be rather less than that of the grooves. Then on approximating the rolls, the axle is squeezed progressively at the same time that it is lengthened. By making the rough bar of an oval section, and placing it between the rolls with its longer diameter in a vertical position, a perfectly round axle would be obtained by the action of the rolls thereon.

In making hinges for carriages and waggons, a plate or matrix similar to that above described, is used, but the matrix must correspond exactly in shape to the three faces of the hinge. The upper roll carries only a projection for forming the contour. If at the same time the matrix is provided with a fixed piece to form the space in the hinge, it will be obvious that the hinge might be entirely completed in the rolls, beyond the drilling of the requisite holes therein for securing it to the waggon, and for receiving the pin of the hinge.

Guard plates are still more easily fashioned by this system. The matrix is very simple, and the upper roll perfectly plain. The semicircumference is formed in the blank, the branches being short in proportion to the thickness of the metal, so that when the piece has by rolling attained its proper thickness, the branches have assumed their desired length. In place of forming the matrix of a depth equal to the desired thickness of the article, it can be made considerably deeper than the rough blank to be finished; but in that case it is requisite to have on the upper roll a projecting portion which will fit exactly the contour of the matrix. By this arrangement the possibility of the metal exuding laterally from the matrix when under pressure between the edge thereof, and the surface of the upper roll is obviated

Spades and shovels are made in the same manner as the guard plate above described, but for greater economy of time and labour, the matrix is made to produce the spades or shovels at one operation, the two being in a line with each other, and formed simultaneously as the rolls reciprocate over them. When completed the article is separated or divided in the middle, and each portion forming a spade or shovel blade. Suitable projections and cavities are made on the upper roll and in the die or matrix for forming the sides or edges of the shovel, or making other impressions or raised parts thereon.

The manufacture of scythes presents no greater difficulties than the making of spades, but as they are not symmetrical in relation to a common centre line or axis, that system which was adopted simply from motives of economy in making spades, becomes in the manufacture of scythes, a necessity, in other words, it is requisite that two, at least, be made at one time; the two being united by the blade, and separated afterwards by shears; the blades having the requisite curvature imparted to them. The blanks from which the scythes are to be made contain sufficient metal in them to form also the handle or socket of the scythe, in the same manner that the spade blanks formed the sockets for the spades. By using rolls of large diameter four scythes can be made at one time. They are united in pairs at the blades, and each pair are united either at the points or at the handles. In place of rolling the scythes lengthwise, they may evidently be rolled crosswise or transversely. In that case the rolls are of small diameter. The blades of the two scythes should be presented to the rolls in such a manner that the straight line of junction between the two be parallel to the axes of the rolls, and the rolling action should commence at this central line.

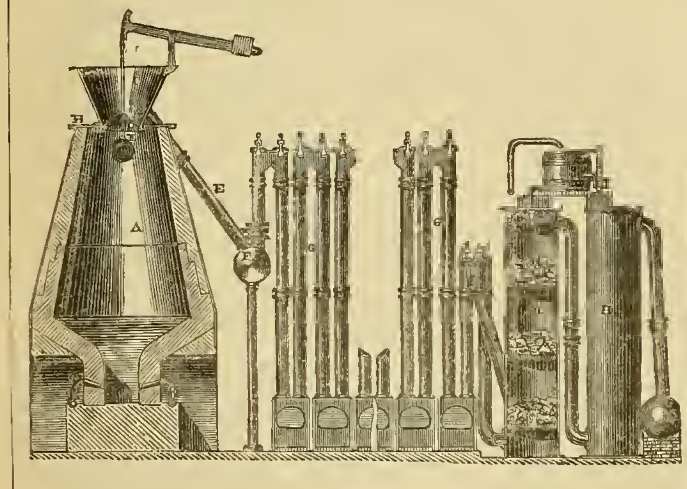
Trowels are manufactured by this novel system of rolling; and from the above the reader will see that by merely altering the shape of the rolls these and many similar articles may be economically produced.

TREATMENT OF BITUMINOUS MINERALS.

Rees Reece, *Llandilo, Carmarthen.—Patent dated 18th Sept*, 1860.

Practical chemists have for sometime past devoted much attention to the treatment of bituminous substances, for the purpose of obtaining the products in the most useful form, for commercial purposes. Mr Reece's present invention consists in effecting the burning and distillation of lignite, and of certain bituminous mineral substances, such as parrot and cannel coal, schistus rock, shale, and the mineral substances known as Boghead coal or Torbanehill mineral, in a furnace, by the aid of a blast, so as to obtain inflammable gases, tar, and other products, therefrom.

The accompanying engraving represents an elevation of the blast furnace condenser and scrubber, in section. A A are the furnaces similar to those that are ordinarily used for the smelting of iron, but are covered on the outside with sheet-iron, so as to render them air-tight; and on the top is placed a cover-plate, as at B. A feeding-hopper, C, and valve, D, to each furnace is provided with two outlet pipes, E, E, which terminate in the hydraulic main, F, to which is connected the condenser or condensers, O G. The extent of this condensing apparatus is regulated according to the capacity of the furnace, so as to be adapted for cooling down to an ordinary temperature the products of condensation, and the inflammable gases proceeding therefrom. H H are the scrubbers or apparatus, connected with the condenser, for washing the gases with water, so as to deprive them of all impurities, which are mechanically carried away with them. These scrubbers are filled, or partially filled with layers of small stones or coke, and are provided with the ordinary float valve, I, and water distributor, K. The mode of arranging these scrubbers, and the apparatus for supplying water to them, in carrying on the process of burning and distillation, in the apparatus, is as follows:—The furnaces, A, are first charged with lignite, cannel, or parrot coal, schistus rock, shale, Boghead, or Torbanehill mineral; then a fire is lighted in the furnaces, and a gentle blast put on, the hoppers, C, are closed, and the products of combustion and distillation pass off from the furnace through the two pipes, E, into the hydraulic main, F, and thence through the condenser, passing through its several tubes, where it is kept as cool as possible. From the condensers the gases pass into the scrubbers, where they are well washed by the descending stream of cold water. The blast is gradually increased, so as to raise the temperature within the furnace sufficiently high to reduce the carbonic acid, generated at the tuyeres, into carbonic oxide. Where schistus rocks, or shale, is put into the furnace, certain quantities of coal are mixed, preferring to use cannel or parrot coal in the proportion of 10 or 20 per cent. When the object is to produce inflammable gas, sufficiently rich in luminous matter to serve for the purpose of lighting, the furnaces are charged with parrot or cannel coal, mixed with Boghead or Torbanehill mineral, the proportion of these substances depending on the quality of the gas required. However, to produce a gas equal in illuminating power to London coal-gas, 70 to 90 per cent. of Boghead or Torbanehill mineral, mixed with 10 to 30 per cent. of cannel or parrot coal, will give a good result; and if a very rich gas be required, the Torbanehill mineral may be used alone. It may be sometimes found advisable to diminish the quantity of nitrogen contained in the gas; and this is effected in the following manner:—The blast injected into the furnace must be heated to 600° or 700° Fahrenheit; and a jet or jets of steam superheated to about 600° or 700° Fahrenheit, sent into the furnace with the blast, or in the form of separate jets, the quantity of steam being so regulated that it be converted into carbonic oxide and hydrogen, the proportion of steam to effect this will be about 10 per cent. of the air injected. It may be generally observed that whether lignite, schistus rock, shale, parrot, cannel coal, Boghead, or Torbanehill mineral be put into the furnace, either alone or in mixture, as above indicated, the condensible products will be nearly the same commercially—that is to say, that the tar collected in the hydraulic main and condensers, and the oils deposited in the scrubbers, will consist of paraffine, both liquid and solid, and a variety of carbo-hydrogens; and these may be eliminated and purified by processes now well known. The gases produced, however, will materially differ—that obtained by treating lignite will have but little luminosity, whilst that which is obtained by treating parrot and cannel, or Boghead coal, may be used for illumination. These gases contain the usual impurities of coal gas, and, therefore, previous to their being used for domestic purposes, either as fuel, or for lighting, require to be purified in the usual manner.



LAW REPORTS.

Re Young's Patent for the Manufacture of Paraffine Oil.—An application was recently made to Sir R. Bethell, Her Majesty's Attorney General, on the part of Mr Gillespie of Torbane Hill, for leave to issue a writ of *scire facias* to repeal Mr Young's Patent. This patent, which, as is well known, has been the subject of great litigation, is for the treatment of bituminous coals, so as to obtain therefrom paraffine oil, and from which paraffine oil is obtained. Prior to Mr Young's patent solid paraffine was only known as a laboratory curiosity, and probably not more than a few pounds of it were in existence. At the present time it is produced by Mr Young and his partners at the rate of several tons a week. The oil now so universally known as paraffine oil was also quite a novelty, so far as any purposes of utility were concerned. The bituminous coals, at present principally employed in this manufacture, are the well known Boghead or Bathgate gas coal, and Mr Gillespie is the owner of a small portion of the coalfield. The reasons put forward by him, as the ground of the application, were, that Mr Young was not the inventor of the process in respect of which the patent was granted, and that his interests were prejudically affected by the patent and the illegitimate use made thereof, to interfere with the sale of the Torbane Hill mineral As to the latter reason it may be stated that the price of this mineral or coal is now from thirty-five to forty shillings per ton, whereas when Mr Young established his works it was not worth more than fifteen shillings a ton. It is therefore clear that instead of the patent having reduced the price of the coal it has greatly increased it.

By way of further explaining the circumstances of the case, it may be mentioned that several years ago, and prior to the date of Mr Young's patent, Mr Gillespie and his wife granted a lease of the lands from which the coal is excavated to Messrs Russell & Co, from whom Mr Young and his partners have been in the habit of purchasing the largest portion of the coal used by them.

In 1852 Mr Gillespie brought an action against his lessees Messrs Russell & Son, in the Court of Session in Scotland, on the ground that the Torbane Hill mineral was not a coal but a shale, and that therefore it was not included in their lease. Upon the trial of this action Mr Gillespie was defeated, the verdict being given in favour of the defendants.

What may be Mr Gillespie's reason for attacking Mr Young's patent does not clearly appear—beyond this, that being part owner of the coalfield, and also in receipt of one seventh of the coals raised by Messrs Russell by virtue of some subsequent arrangement with them, he may suppose that if Mr Young's patent was not in existence, the demand for the Boghead coal would increase, by reason of the numerous manufacturers of paraffine oil who would start up, and that the price of the coal would in consequence be much higher. Be this as it may, he has thought proper to attack the patent in Scotland, by an action of declarator and reduction in the Court of Session, and concurrently to apply to the Attorney General for leave to sue out a writ of *scire facias*, by which, if successful in inducing a jury to find in his favour, he would quash the patent. The "reasons" assigned by him were that, Mr Young was not the inventor of the use of bituminous mineral substances for obtaining paraffine, and paraffine oil, the use of such substances for such purposes having been published and known long before the date of his patent; and that the interests of Mr Gillespie were prejudicially affected by the said patent, and the illegitimate use made thereof to interfere with the sale and use of the Torbane Hill mineral found on his lands.

On the 30th of May last, Mr Aston appeared before the Attorney General to support the application; and Mr Hindmarch and Mr T. Webster, instructed by Mr J. Henry Johnson, appeared to oppose on behalf of Mr Young. After hearing Mr Aston at length, and without calling on Mr Young's counsel to reply, the Attorney General was of opinion that he ought to refuse the application, and he expressed himself as follows:—

I think I am bound to refuse this application. In the first place as a general rule, I cannot allow any application for this writ, which it has been well said, ought to be used for public purposes only, to be made with a view to promote any private end or interest. The applicant here is already engaged in litigation. He is already the pursuer of an action in Scotland, in which he directly challenges this patent. For all immediate purposes therefore, the objects he seeks to attain will be legally raised and will, if he is entitled to it, be decided in his favour in the action which he is at present pursuing in Scotland. I am desired at the same time concurrent with this to permit another proceeding, a general application to be made by the same individual in order to have concurrently proceedings of a similar nature in England. Now these proceedings are admitted on all sides to be extremely expensive, and the result therefore of the proceedings will be to incur a great amount of expense in litigation. I do not see any reason why I should permit that to be done at the instance of a gentleman who has already raised an action for the purpose of determining this very question. That is one reason. Another reason I hold to be this, that as he is more immediately connected with the Scotch patent, although it is perfectly true he may have a very large interest in vending the mineral products of his land in England, yet as he lives in Scotland and is more immediately affected by the Scotch law, I think it is the natural and proper conclusion to permit the Scotch action to go on, and then to allow proceedings or not to allow proceedings after the determination of that suit in Scotland. In the next place, I do not at all hold that there has been any ground laid before me for granting the writ at all. I am told by this gentleman, that this particular patent wholly interferes with his vending this mineral product of the land he possesses in Scotland, in England. I do not read the patent in that way at all. I do not consider that it amounts to anything but a representation of an improved mode of treating a certain bituminous substance, with a view to obtaining a particular extract therefrom. But whether this be correct or not it is only a secondary ground of the decision to which I arrive.

With reference to the interest of the plaintiff, one general rule which is always acted upon, and a very wholesome rule is this, that where the validity of a patent has been acquiesced in by the public for a considerable period of time, it ought not to be lightly challenged. Now I have had no ground laid before me except this, that this particular patent is not new. There is no evidence of any kind upon that point, with the exception of the assertion of the applicant. All these applications must be considered as if they were occurring in court, and when an applicant comes and applies to me for a right to challenge a patent, he must lay some reasonable ground before me. But there is no ground laid before me, except the simple allegation that this is not new. I was about to observe that this patent has been acquiesced in for a considerable period of time. The date of the patent is October 1850. It has not been a thing which has passed without attention, because it has been the subject of repeated legal proceedings. Those legal proceedings I am told have terminated in a compromise. That is immaterial; I advert to the fact of the legal proceedings for the purpose of showing that it is not a patent which has not been used, but that it is a patent which has provoked public attention. The patent has survived all these attacks, because if these actions have terminated in a compromise, I must assume that the parties when submitting to those compromises, felt that they had no ground in law for challenging the validity of the patent. Therefore, I do hold that when a patent is eleven years old, and been acquiesced in generally during that period of time it ought not to be lightly challenged. I quite negative the observation that this gentleman applies in the interest of the public. It would be absurd to hold that he applied in the interest of the public. He has a very special interest of his own. He is shown to have been a very active party in support of the defence made to the action brought by the patentee. He is shown to have a great personal and private interest in the prosecution of the matter. That personal and private interest is represented by his own proceeding in Scotland, and therefore, I feel myself bound to refuse this application.

TELEGRAPH CABLES: GLASS *et al* v. ELLIOT.—A report of a portion of this case appeared in our Journal for May. The action was tried before Lord Chief Justice Erle at the sittings in London after Hilary Term last for malicious injury to a submarine telegraph cable laid from the coast of Suffolk to the Dutch coast. The plaintiffs were employed to lay the wire between England and Holland, and the defendant is manager for Messrs Newall, also electric cable manufacturers of great repute. The charge was, that the defendant had employed a man named Curtis to drive a nail into the cable as it was being paid out from coil in the hold of the vessel employed for the purpose of laying it down, and, Curtis being called at the trial, and giving evidence that he did the injury charged under the direction of the defendant, a verdict passed for the plaintiff. A rule was moved last term by Mr Bovill, Q. C., for a new trial, on affidavits disclosing what was contended to be an important point, that, at the time Curtis went on board the ship with the alleged instructions to injure the cable, a piece of the cable had not been delivered to Boswell to facilitate his giving those directions in the manner spoken to at the trial, and the rule was also discussed with reference to the questions of surprise, and the verdict being against the weight of evidence, although there was some dispute as to whether those were comprised in the grounds on which the rule was originally granted. At the sittings in Banco, before Lord Chief Justice Erle and Justices Williams, Willes, and Byles, Mr Montague Chambers, Q.C., Mr Cleasby, Q.C., and Mr Bidder, appeared to show cause; while the rule was supported by Mr Bovill, Q.C., Mr Denmam, Q.C., and Mr Quain. On the part of the plaintiffs it was urged that Curtis's story was perfectly unimpeached and reliable, and that if the defendant had the means of successfully contradicting him he might have done so at the trial. His description of the manner in which he effected the injury, while there was considerable confusion and a number of men employed about the coil of cable, which covered a large space, was highly probable, and the evidence neither of the defendant nor of Mr Newall could be trusted. The reason the defendant gave for sending his man Curtis on board the plaintiff's ship at all—namely, to find out whether the plaintiffs were not infringing Mr Newall's patent for uncoiling electric cable—was a paltry and unworthy one. With respect to the delivery of the piece of the plaintiff's cable to the defendant, what induced the defendant to get that just at the time the vessel was setting sail to lay it down? The reason given was that it was the custom to collect pieces of rival manufactures as specimens; but, if so, why should it be done in the cautious, underhand way, which seemed to have been followed in this case? A number of letters of Mr Newall and of the defendant, relied upon as affording new evidence of the delivery of the piece of cable, were read and commented on by the learned counsel with a view to showing that they would be ineffectual to do so, and with a view to exposing this underhand method of conducting business and throwing discredit on their evidence. For the defendant, it was contended that Curtis was employed by the defendant solely to obtain a portion of the electric cable being laid down to the Dutch coast in order to see whether or not the plaintiffs were infringing Messrs Newall's patent, whose foreman the defendant was, and that Curtis's evidence, that he was employed by the defendant to damage the cable by driving a nail into it, and thus breaking the continuity of the electric current, was unworthy of belief, and contrary to facts set forth in letters which passed at the time between them. It was contended that the evidence of Curtis was a surprise on the defendant, and on affidavits setting out these facts the learned counsel contended that, on payment of costs, there ought to be a new trial. The Chief Justice asked for copies of the affidavits, and said the Court would take time to consider its judgment.

MANUFACTURE OF STEEL: MEYER *v.* SPENCE *et al.*—This was an action brought by the plaintiff, Jacob Meyer, a steel manufacturer, of Bochum, in the kingdom of Prussia, against the defendants, Messrs Spence and Worthington, steel manufacturers, at Workington, in Cumberland, and tried in the Court of Queen's Bench, before Lord Chief Justice Cockburn, and Justices Wightman, Crampton, and Blackburn, to recover damages for the infringement of a patent granted to Ewald Riepe, on the 29th of January, 1850, for "Improvements in the manufacture of steel," of which patent the plaintiff was assignee. At the trial, which took place before Mr Baron Wilde, at the last summer assizes at Liverpool, the plaintiff was non-suited; but, subsequently, a rule was granted to set aside the nonsuit, and also for a new trial, upon the ground that the learned baron misdirected the jury with reference to the construction of the specification of Riepe's patent, and also in ruling that the construction of the specification as to the meaning of the expression, "finishing process," or as to what was the finishing process intended to be claimed, was a question of law for the judge, and not of fact for the jury. Mr Knowles, Q.C., Mr Maristy, Q.C., and Mr Aston, appeared to show cause against the rule; and the Solicitor-General, Mr Hindmarch, Mr Webster, and Mr J. A. Russell in its support. The question in dispute related to the mode of converting pig iron into wrought-iron and steel by means of puddling, and the construction of the specification of Riepe's patent, and particularly of an expression, "finishing process," contained in it, and as to whether what Riepe claimed in his specification was new, so as to be the subject of a patent. After a lengthened argument, the Court came to a conclusion that the nonsuit was right, and that there was no novelty in Riepe's supposed invention which could be the subject of a patent. Rule discharged.

FURNACES: PRIDEAUX *v.* DARBY.—This was an action tried in the Court of Queen's Bench, before Lord Chief Justice Cockburn, and Justices Wightman, Crompton, and Blackburn. The defendant is an ironmaster in South Wales, and the action was brought to recover damages for an alleged infringement of a patent granted to the plaintiff, on the 30th August, 1849, for improvements in puddling and other furnaces. At the trial, which took place some time since in this court, it appeared that the plaintiff's invention consisted—first, of improvements in puddling, mill, and scap furnaces; and, secondly, of improvements in furnaces for smelting iron ore. The peculiarity of his invention, as described in the specification, consisted of the employment of air under pressure caused to circulate through suitable passages, or ways, to become heated, and then to pass into a closed ash-pit, as shown in the drawings annexed to the specification; the novelty consisting in the use of air forced through heating surfaces, and into a closed ash-pit of a puddling furnace. At the trial the plaintiff obtained a nominal verdict, but leave was reserved to the defendant to move the Court to enter the verdict in his favour, and a rule being granted for that purpose, and also for a new trial, upon ten several grounds stated in the rule, the questions in dispute now came on to be argued. The principal question was as to the novelty of the plaintiff's alleged invention, and whether it had not, in fact, been disclosed in several of the old specifications.

Mr Bovill, Q.C., and Mr Karslake, Q.C., now showed cause against the rule; which was supported by Mr Knowles, Q.C., Mr Ed. James, Q.C., and Mr Hindmarch.

At the close of the argument, Mr Justice Wightman said that, if a new manufacture had been produced, that would have been the subject of a patent, but the mere application of an old machine to an analogous use was not the subject of a patent. In the present case, all that was claimed in the specification was known before; but the ground of the patent was, that it was never used before in the ordinary puddling furnace. It was, however, used in furnaces in which they puddled, but it was said they were not puddling furnaces. He (Mr Justice Wightman), however, thought that the process had been applied to a strictly analogous use, and, upon that ground, the patent could not be supported, and the rule must be made absolute to enter the verdict for the defendant.

Mr Justice Crompton and Mr Justice Blackburn concurred in the opinion.—Rule absolute.

REVIEWS OF NEW BOOKS.

The Theory and Practice of Shipbuilding, by Andrew Murray; with Portions of the Treatise on Naval Architecture, by Aug. Creuze, and Steam-Ships, by Robert Murray. Edinburgh: A. & C. Black.

This volume contains reprints from the last edition of the "Encyclopædia Britannica," of the articles Shipbuilding, Steam-Ships, Timber and Tonnage; and it forms a book which must be indispensable in the office of the naval architect, whether employing wood or iron. Since the late Mr Creuze's treatise on naval architecture was written, great changes have taken place both in the theory and practice of building ships, besides changes in the art of gunnery, and in the nature of the projectiles used. The state of our navy is now attracting a large share of public attention, in the face of the great increase which the navy of our neighbours, the French, has undergone, and is undergoing. Surely in face of the attitude assumed by the head of that nation, wary, able, and unscrupulous as he is, it behoves us to place our own naval affairs on a better footing, and reform a system by which a profuse expenditure is attended by results of such doubtful value. Without turning aside to politics, however, we may say that the publishers have done well to reproduce these articles in their present form, as they will be found well worth the perusal both of the student and the practical man. Mr Robinson, of Chatham Dockyard, has contributed the part relating to the theory of naval architecture. This, of course, has been treated mathematically; and it appears to be soundly written. Numerous woodcuts and large engravings illustrate the text.

Treatise on Mills and Millwork. Part 1.—On the Principles of Mechanism and on Prime Movers. By William Fairbairn, Esq., C.E. London: Longman & Co. 1861. Pp. 281.

No man is more capable than Mr Fairbairn, of instructing the young engineer on this subject. He has had a large experience in the construction of machinery, and he is well known to be a man of original powers and enlarged mind. The student may therefore take up this volume with the expectation of deriving from it a large amount of useful information, and he will not be disappointed. He will eagerly con its pages, and look forward for the appearance of the second part in which the new system of transmissive machinery, and on the arrangements necessary for imparting motion to the various descriptions of mills, will be entered upon. This part of the work explains the first principles of mechanism, and then discusses the various constructions of prime movers. Here will be found information as to the accumulation, storage, and measurement of water; the construction of prime movers depending upon this motive power; with considerations as to the best forms of water-wheels and turbines. A short treatise on the properties of steam, derived from the author's own researches, bearing on the density of steam and the law of expansion of superheated steam, has been inserted, as well as a chapter on engine-boilers—their strength, powers, and principles of construction. There is also a short chapter on wind-mills.

A Treatise on the Steam Engine in its various Applications to Mines, Mills, Steam Navigation, Railways, and Agriculture. By John Bourne; being the Fifth Edition of "A Treatise on the Steam Engine," by the "Artizan Club." Illustrated by 37 Plates, and 546 Woodcuts. London: Longman & Co. Quarto, Pp. 495. 1861.

It will be acknowledged by all who give this work a careful examination, that it is of sterling value, and supplies a great deal of information not to be found in any other quarter. Of all manufacturers of steam machinery, and their name now-a-days is legion, it must be the textbook for continual reference. The student will learn from it leading principles and practical details; for although it contains much that will be at first beyond him, it embraces much that he will not find elsewhere so usefully expounded. The old work by the Artizan Club, though ill put together, contained good matter, and this was so generally acknowledged, that four editions of it were sold. The present edition has received additions and emendations, and has been brought up to the advanced state of our knowledge in this important branch of industry, the right hand of all our manufactures. Much new matter has been introduced, and the work is largely illustrated by woodcuts and plate engravings. It commences with a historical sketch of the origin and progress of the steam engine; and then the scientific principles concerned in its working are explained. In this part of the book the researches into the motive power of heat, and the convertibility of heat and power are set forth. Even the air engine comes in for discussion. In the chapter on Boilers, the question of smoke consumption, as well as the various forms of boilers, are treated of; and then the principal forms of the engine itself are discussed, and practical instructions as to its proportions, manufacture, and management are given. Many subsidiary topics have been dealt with, and in the appendix much useful information is afforded, accompanied by tables. We congratulate the author upon having brought this elaborate work to a successful termination, and we can sincerely recommend it to the favourable notice of the engineering public. It must be the students' chief book for consultation for many years to come.

CORRESPONDENCE.

MAGNETICAL DEVIATIONS OF THE COMPASS.

In my last, I proposed to reason the magnetical indications on hydrostatical principles; that is, the flow of a current. It may be necessary, before proceeding further with this important question, that I define as clearly as possible those terms which we shall require a free use of in the examination of the causes that produce the deviations of the compass in iron ships.

The polarities of the magnetic needle is the first indication of energy, which we may call magnetical force, magnetical energy, or magnetical influence. There is one point that we must endeavour to form as clear a conception of as possible, as we have not as yet any clear definition of the terms, "*polarity*," "*polarities*," as these are generally understood to express two opposite forces, as attraction and repulsion. It has also been defined by Dr Whewell as a *contrast of properties corresponding to a contrast of positions*. With the first part of this definition we have still a difficulty to contend with, as we cannot well define or conceive of a contrast of properties. Of the latter we can form some idea, but we cannot well conceive of energy or motion being a contrast of properties; and it seems evident that, as long as we reason on energy being a property of matter, we shall still have to contend with those mechanical facts which will at all times stand in the path when we endeavour to reason the magnetical laws on mechanical principles. There is no good reason why we ought to reason energy or motion as a property of matter; then, let us assume that the mechanical laws are correct, it must follow that we do not reason the magnetical laws on clearly defined principles.

The term polarity conveys to us an idea of energy or motion; the great question now is, Is energy or motion a property of matter? We think not, for we cannot well conceive of motion resting and then giving motion to itself, nor can we have the perception of matter giving motion to itself; but we can form an idea of matter being passive till acted upon. In this view of the question, we can reason all indication of energy or motion on clear, mechanical deductions; then, let us fix in our mind the meaning of the terms polarity and energy, and what we mean by them. Polarity we apply to matter, and believe it to be a certain condition or arrangement of the atomic mass of matter; and that matter when acted upon by energy is indicative of its influence—the amount of that influence depending on the arrangement or construction of the atomic mass. I know that the question may now be asked, What is energy or motion? Perhaps a blank line might convey as much on this point as any explanation I might offer in words. It is a question that seems, for the time, to be veiled; but I do know what I believe it to be—it is the parent of matter, it is the effect of an eternal and primary intelligent cause, and its effects on inanimate matter constitute one of the great sources of our happiness in observing and studying its laws; but the question may be equally asked, and with as much reason, *What is matter?* Its ultimate basis or properties we know as little of as what we do of the primary cause of motion. In our reasoning on matter, we assume that the mass is formed of myriads of atoms; but we know well that this process of reasoning, when carried to an extreme point, leads us into mazes of difficulty, from which we discover how little we know, and how much we have to learn. It is not absolutely necessary for our purpose that we know from whence matter came, or the energies which bind and impel it throughout space; but we are permitted to observe and mark its various changes—this preparing us for higher and nobler purposes:—

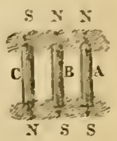
> "All are parts of one stupendous whole,
> Whose body nature is, and God the soul."

It is true, our ideas of polarity are inseparable from the phenomena of magnetism, because it conveys to our minds equal and opposite powers or forces. This hypothesis leads us to conceive of atoms having poles which attract and repel each other, and was suggestive of atoms being surrounded by ethereal fluids. There can be no doubt but these views have gone far to assist inquiry, but they prevent us from reasoning beyond the circle. The polarity of matter seems to form the basis of magnetism by which energy is indicated in all its varied conditions, as electricity, light, heat, chemical action and crystallisation. The magnetical energy or influence, seems to pervade all matter. We can perceive its influence on the suspended prism of glass assuming its equatorial position. This property seems to be indicated by all substances, organic and inorganic. Similar affections are indicated by liquids and gases. From this it would appear that the magnetic energies seem to pervade all bodies, and that its action on matter, and its indications, seem to depend on the arrangement or construction of the mass,—the axis of motion depending on what we will call the polar arrangement of matter, so that energy is indicated by the mass in the same way as a ray of light may be indicated at different angles by a reflector, or as the optic axis of crystals—this depending on the internal polar condition of its prismatic arrangement. It would seem to be a law clearly indicated from the experiments of Dr Tyndall that when the molecular constitution of a body is such that the particles of which it is formed are in greater proximity in one direction than they are in another, the primary direction is the one in which the magnetic energy or force exerts itself with greatest influence.* From the many adducible facts of the condition or arrangement of the atomic mass, they clearly indicate to us that those arrangements determine the direction in which the energies or force is to be indicated, in the same way as a reflector of heat or light may be adjusted to reflect from any degree of the circle; so that, energy or motion may be as varied as a stringed instrument which gives forth a range of notes—their variations depending on the amount of tension, which tension affects the atomic arrangement of the wires.

Let us now assume that polarity conveys to us a certain condition of the atomic mass, which mass is pervaded by energy which continues to act upon it, the atomic arrangement indicating the lines of energy which may either impede or deflect the energy. From this view, we can perceive that by certain arrangements of the atomic mass, that matter may be either compressed, or repelled, thus giving an idea of gravity, cohesion, and expansion. From this view of the question, we may have as many conditions of force indicated as the atomic form may have sides to reflect it. Assuming this hypothesis of energy acting on matter, all the conditions of force may be indicated, as—

Central force is	gravity.
Resisting force is	inertia.
Elastic force is	repellant.
Affinity force is	cohesion.

That we may by analogy form some idea of the polar magnetic indications, let us suppose we have three tubes of any convenient length, and that these tubes are so arranged that water or gas may flow through them (see annexed engraving), A B and C, it will be evident that when the current is flowing through each tube, the upper ends, N N, are the inducing or attracting, which also repels that of the fluid which it cannot receive, and the lower ends repelling, in consequence of the discharge of the fluid, so that the tubes are in a condition of attracting and repelling. But suppose the current in the tube, C, to be reverse to the former, and the current passing up this tube will then be in the condition of being attracted by B, as it will convey the fluid from S up to N, thus equalising each other's forces by a continuous current being formed. This, then, is similar to the effects of two magnets, the one force equalising the other, although the magnet, A, would still maintain its condition of repelling B and C. Suppose these tubes to be transverse to the indicated current, it will be evident that the current would cease to flow, and that the attractive and repelling forces would cease to be indicated, although the flow might continue without that force being indicated, this so far giving an idea of bars that are magnetised, and those that are not.



PAUL CAMERON.

THE SELF-MOTIVE WHEELS OF THE MARQUIS OF WORCESTER, AND M. ORFFYREUS.

AMONG the hundreds of inventions that have been designed for effecting the so-called perpetual motion, none have acquired such celebrity as that by the Marquis of Worcester, prior to 1649, and another by M. Orffyreus, about 1712. As, however, their construction was kept secret, and died with these alleged inventors, we have nothing to guide us respecting them beyond circumstances too meagre to afford any very strong arguments in their favour. The facts that have come down to us may be briefly stated.

The wheel exhibited by the Marquis of Worcester was fourteen feet in diameter, worked by forty 50-lb. weights. He informs us that "all the weights of the *descending side*" are "*perpetually* farther from the *centre* than those of the *mounting* side," yet of equal number and weight. The result that must follow, in such an arrangement, admitting its possibility, is so obvious, so self-evident, that he merely concludes, "he pleased to judge the consequence." The way in which such conditions were obtained, he states thus—"no sooner these great weights passed the diameter line of the upper side but they hung a foot farther from the centre, nor no sooner passed the diameter line of the lower side, but they hung a foot nearer," that is, nearer the centre. The "diameter line" here spoken of is clearly the horizontal diameter, and the conditions are, as if a scale beam 14 feet long, balanced at each end by a fifty pound weight, should have one of those weights brought one foot nearer than the other to the centre—"judge the consequence." Why, it will overbalance. And if the same thing takes place on the horizontal diameter-line of a wheel "perpetually," it will *perpetually* overbalance, and the motion be a perpetual motion. Well may the noble inventor add—"A most incredible thing if not seen!"

This weight moved wheel was shown in action before Charles the First, most of his Court, and some foreign ambassadors. What were they invited to see? Merely a large wheel, weighted with 2000 lbs.! If not intended as a self motive power, it must be deemed entirely a mechanical monstrosity, without aim or object. But it cannot fairly be disputed to have been at least intended to exhibit motive power obtained by a peculiar placement of great weights, at or near the periphery of a large wheel.

The Marquis himself, it is true, has not designated it a "Perpetual Motion," but the *title* he chooses to give it has little to do with the matter—it does not affect results. But, at the same time, he really may have designedly omitted calling it a "perpetual motion," conceiving it sufficient if he could obtain useful motive power from weights caused perpetually to overbalance, so long as a spring or other means acted on them, in a particular direction.

The second invention appeared between 1712 and 1717, constructed in Germany by M. Orffyreus, a Frenchman, whose real name was Bessler. It was in motion for two months, in an apartment at the residence of the Landgrave of Hesse Cassell, where it had also been examined by the eminent mathematician M. Gravesaude, who wrote about it to Sir Isaac Newton, in very commendatory terms. Unfortunately, the inventor was a most eccentric, dogmatic, and violent character, and for this interference broke up the machine. It is remarkable that although he lived many years after, following other pursuits and inventions, he never recurred to the one which alone gave him notoriety.

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* Vide art. 4, on Heat, "Practical Mechanic's Journal," p. 3. April, 1861.

His wheel was 12 feet in diameter, and capable of raising 70 lbs. weight. He published at Cassell, in 1719, a quarto book of 172 pages, entitled "Triumphans Perpetuum Mobile, Orffyreanum." It contains among others the Affidavit of the Landgrave Charles, dated May, 1718; but is chiefly made up of rambling statements, abuse of opponents, and projecting plans for the purchase of his discovery, written in a most egotistical and inflated style, one half in German, the other half in Latin.

The reputed discovery of perpetual motion is something like that we have on record in relation to alchemy. Adepts were not wanting, and the absolute possession of the secret, and the actual performance of transmutation is on record, but unsubstantiated by a single fact. So as regards perpetual motion, no *fact* exists. The Marquis of Worcester meant, no doubt, to publish his invention, whether a mere weight power, or a self-motive power, as we read at the conclusion of the last article, in his "Century of Inventions," (along with the other inventions recorded in that curious work), but he died four years after its publication, without carrying such design into effect.

Everything makes against M. Orffyreus. He certainly was unjust to his patron. He lived 26 years after the publication of his book, a long period to elapse without again engaging in his scheme, or venturing to establish his fame by leaving a written record of his plan, and thus really triumphing over those he assumed to be his traducers and enemies.

The history of this subject offers a serious warning to the superficially informed scientific student, as well as the practical mechanic, who may feel disposed to enter on such labyrinthian pursuits, where the profit at best can be but small, while loss, vexation, and sore disappointment, are sure to follow. For a while they find that "Ignorance is bliss," and in yet a little while longer they find it proves their utter ruin. To the superficially informed man all things are easy, and to him nothing is so absurdly easy as effecting perpetual motion!

Henry Dircks.

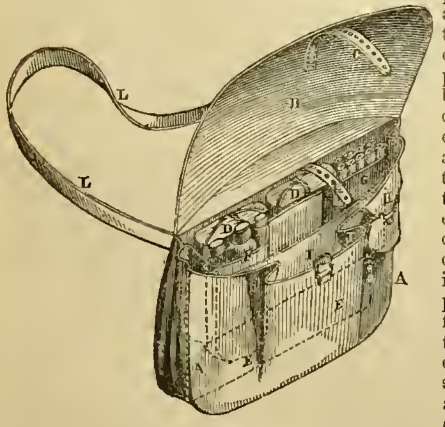
London, *June*, 1861.

REGISTERED DESIGNS.

"AMMUNITION POUCH."

James Kerr, *Superintendent of the London Armoury Company (Limited), Bermondsey, Proprietor.*

The purpose of utility to which the shape or configuration of this design has reference, is the obtainment of a convenient and simple pouch, to be carried by rifle shooters, for holding several packages of cartridges, caps, cleaning implements, and apparatus for extracting a charge from the barrel, thereby comprising in one pouch all the requisites for the practice-ground. The accompanying illustration is a perspective view of the "ammunition pouch," open. A is the body of the pouch, B the cover or closing flap, secured by a strap, C, to a buckle on the back of the pouch; D D D are three compartments, each holding a packet of cartridges. Beneath these compartments a space, E, is left for three other packets, if required, or for any other desired article. The pocket, F, contains a nipple key, screw-driver and cramp, also, a jag and ball-drawer. The pocket, G, serves to contain the X reserve of caps, the immediate supply being contained in an outer pocket. A pocket, I, is also formed inside the front of the pouch, to contain a cleaning rag and oil bottle. This front part of the pouch has gussets, J J, inserted therein, to allow of its expanding, for the reception of any other article the user may desire to carry. K is another strap and buckle for supporting the front part of the pouch, and keeping the various pockets closed.

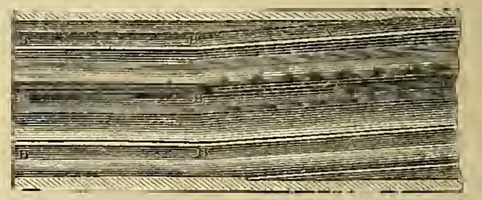


Volunteers, and rifle-shooters generally, will certainly thank Mr Kerr for so useful an addition to their accoutrements.

"RIFLE GROOVE."

James Kerr, *Superintendent of the London Armoury Company (Limited), Bermondsey, Proprietor.*

The object of this design is the prevention of fouling in rifle barrels, and facilitating the proper expansion of the bullet before entering the spiral portion of the rifle grooves. The accompanying engraving represents a plain or flat projection of a portion of the breech-end of a rifle barrel, showing the new form of rifle groove, which has a portion, or short length, B B, made straight or parallel to the axis of the bore at the breech-end of the barrel.



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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the last ordinary monthly meeting of the executive committee of this association, W. Fairbairn Esq., C.E., F.R.S., in the chair, Mr L. E. Fletcher, chief engineer, presented his monthly report, from which we have been furnished with the following extracts. During the past month 210 visits have been made—556 boilers, as well as 407 engines have been examined, and the following defects discovered:—Fracture, 11. Corrosion, 18 (2 dangerous) Safety-valves out of order, 33. Water gauges, ditto, 15 (1 dangerous). Pressure gauge, ditto, 10 (1 dangerous). Feed apparatus, ditto, 3. Blow-off cocks, ditto, 11. Fusible plugs, ditto, 1. Furnaces out of shape, 18. Deficiency of water, 3. Boilers without safety-valves, (1 dangerous). Total, 124 (5 dangerous). Boilers without glass water-gauges, 10. Without pressure gauges, 2. Without blow-off cocks, 32. Without feed back pressure valves, 26. One boiler was found to have its safety-valve placed between the stop-valve and engine, instead of directly on the boiler, so that if at any time the stop-valve should become closed, and accidentally held fast either by the gland or other cause, the communication between the boiler and its safety-valve would be entirely cut off. Three boilers have exploded during the past month, neither of which was, however, under the inspection of this association. These accidents have been attended with loss of life, as well as serious injury to several persons, and considerable damage to property. I examined the scene of the explosion of one of the boilers the day after the accident had occurred, and found that the ruin to the engine and boiler house, as well as to the chimney, was absolute, the bricks being scattered like grape-shot in all directions—one half of the boiler had been blown nearly one hundred yards from its bed, and the remainder torn into as many as eight pieces, which were scattered more immediately around its original position. The cause of the explosion was obvious; the plates had been so reduced in thickness by corrosion, that although originally 7-16 of an inch in thickness, they had become in places literally no thicker than a shilling; and although the bursting pressure of this boiler would not have been less than 400lbs. on the square inch had it been in good condition, it was so weakened as to explode when working with steam at somewhere about 25, or 30lbs. The dangerous condition of this boiler would at once have been apparent upon internal inspection, and none should be worked for any length of time without this, since corrosion is often in action when least suspected.

ROYAL SOCIETY.

May 2, 1861.

"On internal radiation in uniaxal crystals," by Mr Stewart.

"On Fermat's theorum of polygonal numbers," by Sir F. Pollock.

May 30.

"On the elimination of urea and urinary water in their relation to period of the day, season, exertion, and other influences acting in the cycle of the year."

"On the theory of the polyedra," by the Rev. T. P. Kirkman.

June 13.

"On recent scientific researches abroad."

"On liquid diffusion applied to analysis," by Mr Graham.

"On Lane's exploding electro-meter and Leyden jar," by Sir W. S. Harris.

June 20.

"On lunar semi-diurnal variation of barometer," by Mr Brown.

"On atmospheric lines of the solar spectrum, and on certain spectra of gases," by Dr Gladstone.

"On the construction of the great telescope, and observations of nebulæ," by the Earl of Rosse.

"Experimental researches on functions of the vagus and cervical sympathetic nerves," by Dr Waller.

ROYAL INSTITUTION.

May 10, 1861.

"On the relation of the vegetable and animal to the inorganic kingdom," by W. S. Savory, Esq., F.R.S.

May 17.

"On the Theory of Three Primary Colours," by Professor J. C. Maxwell.

Our power of vision depends entirely on our being able to distinguish the intensity and quality of colours. The forms of visible objects are indicated to us only by differences in colour or brightness between them and surrounding objects. To classify and arrange these colours, to ascertain the physical conditions on which the differences of coloured rays depend, and to trace, as far as we are able, the physiological process by which these different rays excite in us various sensations of colour, we must avail ourselves of the united experience of painters, opticians, and physiologists.

Painters have studied the relations of colours, in order to imitate them by means of pigments. As there are only a limited number of coloured substances adapted for painting, while the number of tints in nature is infinite, painters are obliged to produce the tints they require by mixing their pigments in proper proportions. This leads them to regard these tints as actually compounded of other colours, corresponding to the pure pigments in the mixture. It is found, that by using three pigments only, we can produce all colours lying within certain limits of intensity and purity. For instance, if we take carmine (red), chrome yellow, and ultramarine (blue), we get by mixing the carmine and the chrome, all varieties of orange, passing through scarlet to crimson on the one side, and to yellow on the other; by mixing chrome and ultramarine we get all hues of green; and by mixing ultramarine with carmine, we get all hues of purple, from violet to mauve and crimson. Now these are all the strong colours that we ever see or can imagine: all others are like these, only less pure in tint. Our three colours can be mixed so as to form a neutral grey; and if this grey be mixed with any of the hues produced by mixing two colours only, all the tints of that hue will be exhibited, from the pure colour to neutral grey. If we could assume that the colour of a mixture of different kinds of paint is a true mixture of the colours of the pigments, and in the same proportion, then an analysis of colour might be made with the same ease as a chemical analysis of a mixture of substances.

The speaker then next drew attention to the physiological difficulties in accounting for the perception of colour. Some have supposed that the different kinds of light are distinguished by the time of their vibration. There are about 447 billions of vibrations of red light in a second; and 577 billions of vibrations of green light in the same time. It is certainly not by any mental process of which we are conscious that we distinguish between these infinitesimal portions of time, and it is difficult to conceive any mechanism by which the vibrations could be counted so that we should become conscious of the results, especially when many rays of different periods of vibration act on the same part of the eye at once.

Young supposes that the eye is provided with three distinct sets of nervous fibres, each set extending over the whole sensitive surface of the eye. Each of these three systems of nerves, when excited, gives us a different sensation. One of them, which gives us the sensation we call red, is excited most by the red rays, but also by the orange and yellow, and slightly by the violet; another is acted on by the green rays, but also by the orange and yellow, and part of the blue; while the third is acted on by the blue and violet rays.

If we could excite one of these sets of nerves without acting on the others, we should have the pure sensation corresponding to that set of nerves. This would be truly a primary colour, whether the nerve were excited by pure or by compound light, or even by the action of pressure or disease.

The speaker exhibited mixtures of the colours of the pure spectrum. Light from the electric lamp was passed through a narrow slit, a lens, and a prism, so as to throw a pure spectrum on a screen containing three moveable slits, through which three distinct portions of the spectrum were suffered to pass. These portions were concentrated by a lens on a screen at a distance, forming a large uniformly coloured image of the prism.

When the whole spectrum was allowed to pass, this image was white, as in Newton's experiment of combining the rays of the spectrum. When portions of the spectrum were allowed to pass through the moveable slits, the image was uniformly illuminated with a mixture of the corresponding colours. In order to see these colours separately, another lens was placed between the moveable slits and the screen. A magnified image of the slits was thus thrown on the screen, each slit showing, by its colour and its breadth, the quality and quantity of the colour which it suffered to pass. Several colours were thus exhibited, first separately, and then in combination. Red and blue, for instance, produced purple; red and green produced yellow; blue and yellow produced a pale pink; red, blue, and green produced white; and red and bluish green produced a colour which appears very different to different eyes.

May 31.

"On the nutrition and reparation of the nerves," by Dr A. Waller.

INSTITUTION OF CIVIL ENGINEERS.

March 19, 26, and April 9, 1861.

The discussion upon Mr Murray's paper on the North Sea, with remarks upon some of its estuaries, rivers, and harbours, occupied the whole of the three evenings.

April 16.

"On the Floating Railway across the Forth and Tay Ferries," by Mr Wm. Hall, A.I.C.E.

One of the chief difficulties which had to be overcome arose from the difference in the levels of low and high water, averaging 16 feet at spring tides. Several plans were proposed; among others hydraulic and steam cranes to lift, or lower the waggons, but it was considered that this would be too slow a process, as well as be liable to damage the waggons. Another design proposed girders 100 feet in length, having one end hinged on shore, and the other attached to a floating caisson, to rise and fall with the tide; but, owing to the exposed situation, this would have rendered necessary the construction of costly protecting piers and jetties.

The works actually carried out at the Forth Ferry consisted, on the east, or sea-side of the piers at Granton, and at Burntisland of a slipway, having an inclination of 1 in 6, and constructed of solid masonry. Rails were laid upon this slipway, on which traversed a heavy platform, of a wedge shape, the upper surface being always horizontal. This platform was 65 feet in length, and 21 feet in breadth, and was formed of a wooden framework, having four main longitudinal timbers, into which rails were sunk. The platform rested upon twenty-four cast iron wheels, each 30 inches in diameter, with a flange cast on the middle of the rim, so as to allow the wheels to bear evenly on both sides of the rails. To the sea-end of this travelling platform were attached, by means of universal joints, four wrought-iron trough girders, for spanning the distance between the platform and the stern of the vessel. The girders were raised or lowered, as required, by two powerful winch crabs, placed on a staging elevated above the platform, at about the middle of its length. The two chains, one on each side, for lifting the girders, were passed round the barrels of the crabs, and thence over two derricks to the ends of the girders, counterbalance weights being attached to the other ends of the chains. To provide for the safety of the platform, in the event of the fracture of the hauling chain, two lines of racks were laid along the surface of the slipway, into which worked palls, attached to the axles of the wheels. Steel points, turning on hinges, were attached to the ends of the girders, and also to the pier-ends of the main timbers of the platform, to prevent an abrupt transition of the waggons to or from the vessel. Each of the universal joints, by which the girders were attached to the platform, consisted of a bolt, or pivot, 3½ inches in diameter, the middle of which was ball-shaped, and worked in a corresponding portion of a cup, or socket. This socket was circular, and was made in two parts, having a projecting collar and flanges, which were clipped by and were bolted to the plates fixed to the main timbers of the platform. The socket was shaped in a radial form, to allow the pivot full play, and to permit of the ends of the girders moving 3 feet on each side. By these means a range of position was obtained to the extent of 6 feet, to compensate for the pitching or rolling of the vessel.

A stationary steam engine of 30 H.P., similar to a locomotive with the wheels removed, was fixed on the quay for raising or lowering the platform, and for drawing the waggons off the vessel. On the crank-shaft of the engine was fixed a pinion working into a wheel, on the shaft of which were three winding drums, one placed in the middle of each line of rails, and one in the centre of the intermediate space. The winding drums were 2 feet 10 inches in diameter, with flanges, on the periphery of which wood was bolted, and round which there was a wrought-iron friction band acting as a break. The speed of the engine was decreased by toothed wheels and pinions; seventy strokes of the engine giving thirty-five revolutions to the drums, and, by other intermediate wheels and pinions, three revolutions and one-fifth to the chain wheel. The weight of the platform was about 70 tons, and it was moved up and down the incline at a velocity of 18 feet per minute.

The steam vessel, named the "Leviathan," for conveying the goods traffic across the Forth, was built by Mr R. Napier. It was constructed of iron, 172 feet long, 54½ feet in breadth over and 34 feet between the paddle wheels, with

11 feet depth of hold. The draft of water when loaded was 6½ feet and when unloaded 4¾ feet. The vessel was propelled by two steeple engines, each working its own paddle, of the collective nominal power of 210 H.P. On the deck there was standage for three lines of waggons, the end ones on each line being "scotched." The description of rail used throughout was the inverted bridge-rail, weighing 53 lbs. to the yard, the same as on the Granton Pier; and they were sunk into the longitudinal timbers, so as to be flush with the surface of the deck.

APRIL 23.

"On the national defences," by Mr G. P. Bidder, jun., B.A.

APRIL 30, MAY 7 AND 28.

The discussion on Mr Bidder's paper was continued on these evenings.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

APRIL 16, 1861.

Mr E. W. Binney exhibited some peculiar specimens of peat, collected from the low mosses adjoining the sea near Southport.

"Theorems on groups," by the Rev. T. P. Kirkman.

"On the production of graphite by the decomposition of cyanogen compounds," by Dr P. Paulli.

MONTHLY NOTES.

MARINE MEMORANDA.

A course of experiments has been entered into at the long range, in Woolwich marsh, for the purpose of testing the effect of liquid iron on a ricochet gun battery, supposed to be engaged in active warfare. A number of gun carriages, platforms, and dummies in wood, representing artillery men, distributed in zig-zag fashion, were planted about the battery, which received the storm of molten fire poured in rapid succession from Martin's shells, fired from a couple of 68 pounder smooth bore guns. The effect, it appears, was satisfactory. The guns were supplied by 50 gunners of the Royal Artillery, and were fired at an elevation of five degrees over a range of 600 yards. The iron was melted in one of the new cupolas, of which 300 have been received at Woolwich for distribution around the coast, and to the colonies abroad.

The line-of-battle ship *Bombay*, 81, after having been several months in dock at Chatham undergoing the process of conversion from a sailing ship to a screw steamer, has been placed alongside the sheer-hulk to receive her engines and machinery. While the *Bombay* was in dock she was cut asunder amidships and lengthened 33 ft. 9 in., and was also lengthened aft by an addition of 12 ft. She has been completed in the strongest possible manner, and is now the finest 81 gun line-of-battle screw steamer in the British navy. The *Bombay* is to be immediately fitted with a pair of 400-horse power engines, by Messrs Humphreys, Tennant, & Co., a portion of her machinery having been fixed on board during the time she was in dock. Below the water-line she is covered with Muntz's patent metal. It is understood that the *Bombay* will be the last of the line-of-battle sailing ships which will be converted to screw steamers, the Admiralty having determined on having in future only a few of the modern 50-gun sailing frigates of the Nankin class so treated.

A series of interesting experiments was very recently made at Shoeburyness, with a view of testing the effect of heavy shot on iron batteries, which had been previously found to stand any amount of pounding with the lighter projectiles from a 68-pounder smooth bore. The battery was built up as a solid wall of iron, 10 inches thick, on Thornycroft's system of dovetailing, and was backed up in the strongest manner with heavy timber, and braced with iron bars. It conveyed the impression that, after having stood the brunt of so much firing, the battery might, for all practical purposes, be considered indestructible. The first shot was fired from an Armstrong 120-pounder short gun, with a projectile weighing 126 lb.; and such was the effect of this mass, combined with its velocity, that at a distance of 600 yards it cleared out one of the plates 10 inches in thickness, and, at the same time, carried away the back fastenings. The second shot was fired from an ordinary 100-pounder Armstrong, with a solid projectile weighing 110 lb. This struck the battery at another point, but without doing equal damage with the first shot, yet making a breach clean through the entire structure, and so weakening it as to insure its entire demolition by a few more shots. One more sufficed for the purpose, and this, the third, was directed to a part affording some stability to the superabundant mass. The missile, weighing again 110 lb., was, as before, fired from a 100-pounder gun, and it brought the whole battery, above the point struck, immediately to the ground.

The additional batteries and fortifications which the Government has resolved upon erecting for the further protection of Chatham and Sheerness are to be at once proceeded with, orders having been received on Saturday from the War Department to that effect. The south side of the entrance to the River Medway will be protected by a casemated battery, on which will be mounted the most powerful ordnance now in use, consisting of 100-pounder Armstrong guns, 68-pounders throwing hollow and solid shot, and 10-inch guns for either shot or shell. This new battery will be entirely bomb-proof, and it is intended to erect it on the site of the existing old works at Garrison Point, which now mount only 28 8-inch guns. The demolition of this portion of the defences at the mouth of the Medway will entail the destruction of the store rooms and magazines at present filled with shot, shell, and other armament, ammunition, and stores, the whole of which will be removed to the expense magazines, situate in the interior of the existing fortifications. The whole of the guns now planted on the half-moon and cavalier batteries will be commenced to be dismounted to-day, in order that the armament may be removed to allow the process of reconstructing that portion of the works to be at once proceeded with. It is intended that the batteries on the lines adjoining the works ordered to be demolished shall not be disturbed for the present, as it is deemed inexpedient to weaken the defences at the river's entrance by commencing the dismantling of the fortifications on anything like an extended scale. The new casemated batteries will therefore be reared with all possible despatch, and be thoroughly armed and equipped with projectiles of every description before any of the remaining defences will be dismantled. Orders have also been received at Chatham for two batteries to be planted on each side of the River Medway at Folly Point and Bishop's-marsh, about mid-distance between Sheerness and Chatham, for the protection of the latter dockyard and the extensives stores of ammunition accumulated at Upnor Castle. The works connected with the erection of the two batteries mentioned will be executed by the firm of Myers & Co., London, who have taken the contract for the completion of those defences.

BOATBUILDING MACHINERY.—A company is about to be introduced for the application of the patents of Mr Nathan Thompson, an American engineer, for boat building by steam machinery. This machinery is suitable for the construction of boats of every size and mould, and durability and safety are attained from the uniformity and perfection of the various fittings, while the saving in time and labour is extraordinary. The inventor has published testimonials from a large number of the principal persons in the United Kingdom connected with navigation and the working of elaborate constructive establishments, and these are all of the most unequivocal character as regards the value of the system both in a national and commercial sense. "A cutter 30 feet in length can," it is said, "be constructed and delivered perfect in every respect within a few hours after the order is received for it," and the Master Shipwright of Woolwich Dockyard, who was appointed by the Admiralty to examine and report on the method, has fully corroborated the opinions expressed by other authorities. The revolution which it is likely to create will, it is believed, be analogous to that effected in other departments of labour by the sewing machine, and the contrivances which have of late years multiplied the production of clocks and watches. In our colonies and distant territories, where so much of the progress of each settlement depends upon the facilities for river and coast navigation, its advantages are likely also to be of especial importance.

THE BRUNEL AND STEPHENSON STATUES.—At a meeting of the committee on Friday, it was determined that the statues to the memory of these eminent engineers shall be placed in propinquity to the statue of Pitt, in the gardens of St Margaret's, Westminster, facing the House of Commons, Old Palace-yard. They are to be executed in bronze by Baron Marochetti.

PAPER.—An Excise return just issued shows how the number of paper mills at work in the United Kingdom has been gradually decreasing for years. In 1838 it was 525; in 1860 only 384. The decrease in England in that period was from 416 to 306; in Ireland, from 60 to 26. But the quantity of paper manufactured rose from 93,466,286lb. at the former date (1838) to 223,575,285lb. in 1860.

THE AMERICAN TRADE.—The trade of this country with the United States during the first quarter of the present year is stated to have consisted of imports of American produce to the estimated value of £14,046,548 and of exports of British manufactures of the declared value of £4,147,019, showing a balance of £10,899,529 payable to that country. As the figures of the same period of last year consisted of imports £11,087,720, and exports £5,886,357, the balance payable to America on that occasion was £5,201,363. Notwithstanding, therefore, the enormous quantities of wheat and flour we have now taken, the increase this year in the balance to be paid was not more than £5,698,166.

WOOL.—The quantity of wool imported last year exceeded the receipts of any previous 12 months, having amounted to 148,396,577lb., as compared with 133,284,634lb. in 1859; 126,738,723lb. in 1858; 129,749,898lb. in 1857; 116,211,392lb. in 1856; 99,300,446lb. in 1855; 106,121,995lb. in 1854; 119,396,449lb. in 1853; 93,761,458lb. in 1852; 83,311,975lb. in 1851; 74,326,778lb. in 1850; 76,768,647lb. in 1849; 70,864,847lb. in 1848; 62,592,598lb. in 1847; 65,255,462lb. in 1846; 76,813,855lb. in 1845; 65,713,761lb. in 1841; and 49,243,093lb. in 1843. The British pastoral colonies have more than grappled with the ever-growing wants of the home market:—The value of the wool imported was last year £11,031,479, as compared with £9,826,852 in 1859; £8,972,218 in 1858; £9,681,541 in 1857; £8,664,420 in 1856; £6,527,325 in 1855; and £6,499,004 in 1854.

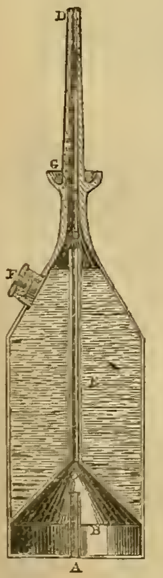
STREET TRAMWAYS.—The Railway Department of the Board of Trade, in reporting on this subject, state that the introduction of tramways to be worked by animal power into streets of populous towns has been attended with advantage, as they afford increased facilities in speed, convenience, and cheapness, in conveying passengers, and especially goods or traffic between distant points, and particularly to or from the terminal stations of rails which, in a large city, are generally situated at a considerable distance from its centre and each other, but where the streets are narrow, turns sudden or frequent, cross-streets numerous, and the traffic large, the advantage may not so much outweigh the inevitable inconveniences as to render it desirable to permit the construction of the tramway, or, at least, the use of it, at a rate of speed exceeding that which vehicles can maintain on the ordinary road. In any case where statutory powers are given for the construction of a tramway along the open streets of a town it would be proper that the greatest height and depth of the tram above or below the surface of the road should be limited.

The Consumption of Tea.—A Parliamentary return states the quantity of tea annually consumed in the United Kingdom, with the average rate and aggregate amount of duty collected thereon; also, the average price, inclusive and exclusive of the duty, and the average quantity consumed by each individual of the population, from 1801 to 1860 inclusive. The increase in the quantity consumed has been singularly steady, fluctuating here and there, but recovering the following year with a new impetus. We take the particulars at the commencement and the end of the period covered by the return. In 1801, when the average price per lb., inclusive of duty, was 4s 2½d, the quantity of tea consumed in the United Kingdom was 23,730,150 lb., and the amount of duty received thereon was L.1,423,600. In 1860 as much as 76,816,394 lb. was consumed, the average price per lb., including duty, being 2s 10¾d. The average quantity consumed by each individual of the population was 2 lb. 10 oz. in 1860, and 1 lb. 8 oz. in 1801. The average rate of duty per lb. paid by the consumer was 1s 2½d in 1801, and 1s 5d in 1860.

The Exhibition Building.—The contractors are now hard at work on the building. The foundations have already consumed 5,000 tons of concrete, which, as the first item, is pretty fair. On these foundations will be laid nearly 60,000 tons, or 1,400,000 cubic feet, of brickwork, requiring upwards of 18,000,000 bricks to build it. To 18,000,000 bricks no less than 22,000 tons of mortar will be requisite. 10,000 tons of ironwork—viz., about 7,000 tons of cast, and 3,000 tons of wrought iron—will be used in the entire structure. As there are nearly 1,200,000 superficial feet of flooring, the same amount of timber as of iron is required—namely, 10,000 tons. The flooring alone consumes 360 miles of planking, seven inches wide, and 270 miles' length, nine inches wide, or upwards of 600 miles' length of planking in all. The actual quantities are 1,200,000 and 2,000,000 lineal feet of each kind. For the windows no less than 108 miles' length, or 600,000 feet of sashing will be required, to fill in which are required 500 tons of sheet glass, and upwards of 50 tons of putty. The roofs will need 600,000 square feet of felt; and among the minor items are between 200 and 300 tons of nails, 600 tons of paint, 300 tons of piping, and so on. The cubical contents of the whole structure will be no less than 73,000,000 cubic feet.

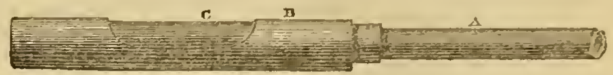
The Ordnance Survey.—The progress of the Ordnance Survey was greatly retarded during the past year, not only by the wet summer and severe winter, but by the employment of 390 surveyors and draughtsmen upon surveys and plans connected with the defences of the country. But the great survey, on the scale of 25 inches to a mile, is being gradually prosecuted in Scotland and in the northern counties of England; and Colonel Sir H. James suggests, in his report for the year, that it should be at once decided whether the cadastral survey is to be extended to the rest of England, so that in that case it may be undertaken while we have an admirably trained body of men for the performance of the work. If we are to have in England, as in Ireland, a Landed Estates Court to give facilities for the transfer and registration of property, an accurate survey will be of much importance. The cost of completing this great work was estimated last year at not exceeding £1,450,000, and likely to be less. Plans illustrating the movements of the allied forces in China have been published by this department, the topographical department of the War-office, and copies sent to all the regiments in the service.

Oil Can.—The subjoined engraving represents a sectional elevation of an oil can patented by Messrs Lister & Lees, of Oldham. The body of the can is cylindrical, the upper part tapering towards the pouring-tube. At the bottom of the can is a tube, A, for the admission of air to the chamber, B, which is of a conical figure. From the centre of this chamber a tube, E, is carried up into the oil tube, D. The space around the tube, E, forms the oil chamber, which is filled from time to time by means of the lateral tubular opening at F. A cup-shaped trough, or receiver, G, is formed round the tube, D, to catch any oil that may flow down the tube after using the can. The admission of air may be so regulated as to admit of the oil flowing very slowly, or otherwise, as may be required; and when left in a horizontal position, the oil cannot escape and run to waste.

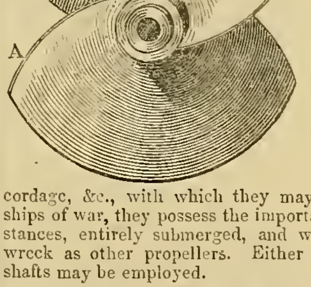


Death of Mr George Bishop, F.R.S.—This zealous devotee of astronomical science expired on Friday evening at his residence, South Villa, Regent's Park, having nearly completed his 77th year. Mr Bishop successively filled the offices of Secretary and Treasurer of the Royal Astronomical Society, and was elected President of that body in 1857. His observatory, which he maintained in activity for nearly a quarter of a century, has contributed, in addition to incidental work, an extensive catalogue of double stars, 11 new planets, two comets, and upwards of 25 variable stars to our list, besides a remarkable star which suddenly became visible in 1848, the only one of its nature which has been seen since the year 1670. He always evinced a deep interest in the dissemination of astronomical knowledge, and invariably welcomed any visitor to his observatory who might be desirous of a practical acquaintance with his favourite science. His munificence in the cause of astronomy is well known, and will insure him a prominent and lasting place in the roll of wealthy amateur scientists—a class of which this country has just reason to be proud.

Eye Tube.—A neat and very compact arrangement of apparatus for bathing the eyes, or for removing sand or other injurious bodies from them, has been recently introduced by Mr Charles Savery, of St Leonards-on-Sea. Our illustrative engraving respresents a side view of the tube. The instrument consists of a small glass tube, A, about two inches long, attached to a piece of vulcanised india rubber tubing, C, stopped at its other end, and which is enclosed in a silver case, B, leaving an opening at the side to allow the tubing to be compressed by the thumb. When used, the elastic tube, C, is compressed, and the point of the glass tube, A, is dipped into the fluid, the pressure being then removed, the fluid is drawn up into the glass tube, and may be easily ejected into the eye by renewed pressure. A pull-off tube encloses the glass when not in use, and defends it while in the pocket case. The instrument is manufactured by Mr C. Baker, of High Holborn, London.



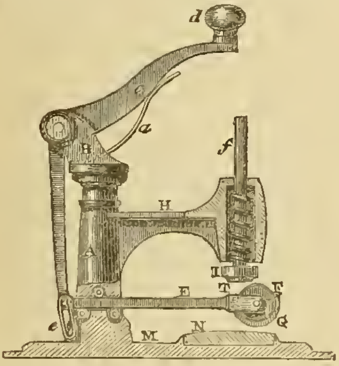
Eccentrical Propeller.—This form of propeller is the invention of Mr W. H. Crispin of Stratford, London. This invention possesses several advantages over the propellers ordinarily in use. Its propelling power is greater than that of a screw of the common form containing the same area, and is less liable to be clogged or fouled; for, while revolving, it repels any floating substances which may be near it, the blades also clearing each other, and the diameter of the entire propeller being 30 per cent. less than that of the propellers in common use. Great facilities are also obtained for turning astern, and the ship will steer better—a large portion of the rudder being below the action of the propeller. Another advantage is, that the edges of the blades (which are flat and not forming any portion of a screw) may be made thin and sharp, and, being on the curve, will divide any cordage, &c., with which they may come in contact; and, when applied to ships of war, they possess the important advantage of being, under all circumstances, entirely submerged, and will not be so much exposed to shot and wreck as other propellers. Either spherical bosses or cylindrical spindles or shafts may be employed.



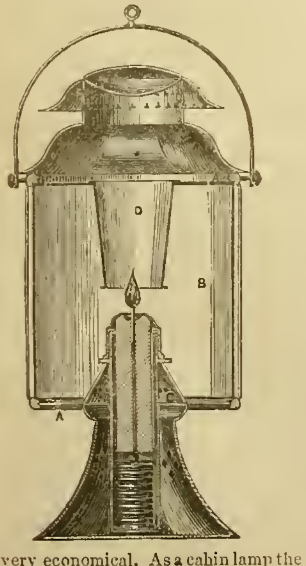
The Great Eastern.—During the first three days of this vessel's recent voyage to New York she encountered very heavy weather, the wind blowing from the south-west with almost the violence of a hurricane and a tremendous beam sea on. To this the *Great Eastern* rolled very heavily, so much as to capsize and knock about all unsecured tables and chairs below, and break the stays of some of the fore and aft trysail booms, which dropped over so much from side to side with each lurch of the ship that it became necessary to lower them. This was a work of great risk and difficulty, and while accomplishing it one of them fell, smashing the skylights of a saloon and fractured the boatswain's leg. The gale lasted three days, and at last rose to such violence that the course was obliged to be altered, and the vessel kept head to wind at half-speed, for 4½ hours. While thus, though the sea was exceedingly heavy, there was scarcely any motion in the vessel. The rest of the passage across was through calms and dense fogs, the whole journey, in spite of the unfavourable and thick weather, being accomplished in nine days 13¾ hours, one of the shortest ever made. During the whole run both screw and paddle engines worked easily and well, the latter averaging a little under 10 and the former about 37 revolutions per minute. The consumption of coals on the whole voyage was only 1,444 tons, or about 116 tons a day. The number of knots run during each day during the 9½ days was respectively 208. 332. 342, 335, 340, 215, 325, 350, 300, 270. The greatest run therefore was during Thursday, the 9th, when the ship averaged for 24 hours a speed of little more than 14½ knots, or very nearly 17 miles an hour. The lowest run was 215 knots, or just 9 knots an hour. During the greatest day's run 119 tons of coals were consumed, and during the slowest 103 tons. The average pressure of steam in the engines throughout was 21½lb. The density of the water in the boilers was 1¾; the vacuum in paddle engines, 25½; in the screw, 26. All the injectors worked well, and there was no perceptible wear in the screw shaft bearing. The total number of revolutions made by the paddle engines from first to last was 133.000, and of the screw 525,276. The effective diameter of the paddle-wheel was 51 feet, or 160 feet each revolution. As far as the machinery is concerned the whole voyage was considered in the highest degree satisfactory, and it is expected that with fair weather the voyage will be made in little over eight days. She has been chartered by Government to take troops out to Canada.

The Coal Trade.—The total quantity of coal and coke exported from the various coal ports of the United Kingdom during the month of April was of coal 746,116 tons, and of coke 29,227 tons. Of this quantity, which shows a very large increase when compared with the returns for the preceding month, Newcastle-upon Tyne exported 226,829 tons of coal, and 14,704 tons of coke; Shields, 7,416 tons of coal, and 275 tons of coke; Ayr, 340 tons of coal; Blyth, 11,038 tons of coal; Amble, 5.412 tons of coal; Sunderland, 118,737 tons of coal, and 3,499 tons of coke; Seaham, 4,432 tons of coal; Stockton, 395 tons of coal; Hartlepool and West Hartlepool, 56.656 tons of coal, and 5.650 tons of coke; Hull, 13,916 tons of coal; Goole, 19 tons of coal; Middlesborough, 13,201 tons of coal, and 3.913 tons of coke; Maryport, 3,599 tons of coal; Liverpool, 57,770 tons of coal; Whitchaven, 1,087 tons of coal; Cardiff, 97,777 tons of coal, and 467 tons of coke; Newport, 16,633 tons of coal; Llanelly, 14,513 tons of coal; Swansea, 40,545 tons of coal, and 415 tons of coke; Greenock, 9,386 tons of coal; Alloa, 5,775 tons of coal; Glasgow, 7,791 tons of coal, and 102 tons of coke; Port Glasgow, 2,519 tons of coal; Charlestown, 6,385 tons of coal; Grangemouth, 8,962 tons of coal, and 132 tons of coke; Inverkeithing, 2,660 tons of coal; Borrowstoness, 2,739 tons of coal, and 70 tons of coke; and St David's, 9,583 tons of coal. The quantity of coal, coke, and culm shipped during the month to different ports in the United Kingdom was, of coal, 703,589 tons; of coke, 2,821 tons; and of culm, 10,833 tons. Of this quantity, which is not quite equal to the shipments made in the month of March, Newcastle shipped 143,436 tons of coal, and 1,294 tons of culm; Shields, 82 tons of coal; Blyth, 8,604 tons of coal; Amble, 402 tons of coal; Sunderland, 130,137 tons of coal; Seaham, 54,639 tons of coal; Hartlepool and West Hartlepool, 92,043, tons of coal, and 314 tons of coke; Stockton, 50 tons of coal; Middleshorough, 10.804 tons of coal, and 356 tons of coke; Goole, 7,187 tons of coal; Ayr, 8,054 tons of coal; Swansea, 22,085 tons of coal, and 7,076 tons of culm; Alloa, 804 tons of coal; Borrowstoness, 4,348 tons of coal; Cardiff, 88,048 tons of coal, and 722 tons of coke; Inverkeithing, 771 tons of coal; Whitehaven, 12,652 tons of coal; Llanelly, 35,236 tons of coal, and 3,757 tons of culm; Charlestown, 5,100 tons of coal; Newport, 53.369 tons of coal, and 132 tons of coke; Maryport, 25,605 tons of coal, and 3 tons of coke; and St David's, 133 tons tons of coal. During the month 4,385 vessels were engaged in the home and 2.979 in the foreign coal trede.

Stamping Press.—Messieurs Gerly & Brizard, of Paris, have recently introduced some simple and effective modifications in the construction of self-inking stamping presses. Our illustration represents a vertical longitudinal section of one of these presses. The main body of the press consists of a metal pillar, A, the upper part of which terminates in a forked bracket, B, in which works a bent lever, *c*, provided at its upper end with a knob, *d*, whilst the lower end is slotted at *e*, and is connected by a pin-joint to the rod, E, the forked end of which contains the inking roller, F, partly covered by the protecting cylindrical jacket, G. The pillar, A, has a bracket or arm, H, cast upon it, in the outer end of which works the rod or spindle, *f*, of the die-holder, I, which is kept elevated by a spiral spring inside the bracket. In the table, M, which serves as the base to the press, is a recess immediately under the die, T, in which recess is fixed a pad of Indian rubber, N. The rod, E, has a horizontal movement imparted to it by the lower end of the lever, *c*, and it slides between anti-friction rollers contained in the pillar, A. On pressing down the knob, *d*, an angular movement is imparted to the lever, *c*, and the blade-spring, *a*, is depressed; this movement draws back the rod, E, and with it the inking roller, F, which inks the die, T, as it moves onward, leaving a free passage for the descent for the die-holder, I, which is caused by the pressure of the lever, *c*, on the head of the spindle, *f*. When the stamp has been impressed the knob, *d*, is released, and the spring, *a*, raises the arm, *c*, whilst the spiral raises the die, thus bringing the machine to its normal position again.



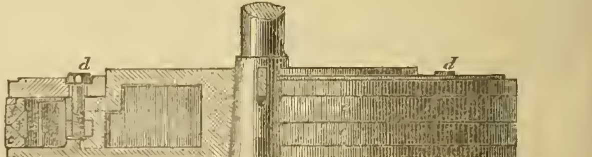
Ship and House Lantern.—A very useful and convenient arrangement of lantern, adapted for use on board ship as well as for general domestic purposes, has been introduced by Mr P. J. Marshall, of Plymouth. The accompanying engraving represents a vertical section of the lamp. The octagonal stand supports a circular metal frame, A, the upper ring of which is connected to the lower by small rods or bars. A circular glass, B, fits into the metal frame, A, and round the candle holder, C, which can be removed. The candle holder, C, has holes formed in it to admit air into the lantern from the stand, which is also perforated. A conical chimney, D, is arranged above the candle which can be removed. A reflector is placed round the chimney and rests on the upper edge of the circular glass, B. An octagonal cover is hinged to the upper ring of the frame, A, and the upper part of this cover is perforated for the exit of gas and air, and is further provided with a cap, having a round bottom, the lower part of which is exposed to the heat and smoke arising from the candle, which passes off through the perforation round it. To the frame, A, is fitted a handle with a swivel eye in the centre, for suspending the lantern. The candle holder is constructed to burn composite candles, which do not require snuffing, and are very economical. As a cabin lamp the arrangement is neat in appearance, affords an excellent light, and is very safe.



The Supply of Cotton.—Official returns just made public afford interesting particulars with regard to a topic which just now commands a larger share than ever of public attention,—viz, the supply of raw cotton. The receipts during the last 18 years have been as follows:—1843, 673,193,116 lb.; 1844, 646,111,304 lb.; 1845, 721,979,953 lb.; 1846, 467,856,274 lb.; 1847, 474,707,615 lb.; 1848, 713,020,161 lb.; 1849, 755,469,012 lb.; 1850, 663,576,861 lb.; 1851, 757,379,749 lb.; 1852, 929,782,448 lb.; 1853, 895,298,749 lb.; 1854, 887,333,149 lb.; 1855, 891,751,952 lb.; 1856, 1,023,886,304 lb.; 1857, 969,318,896 lb.; 1858, 1,034,342,176 lb.; 1859, 1,225,989,072 lb.; 1860, 1,390,938,752 lb. It will be observed that last year's import was the largest on record, exhibiting an increase of 49 per cent. as compared with 1852, and 121 per cent. as compared with 1843. The supplies obtained were derived from various sources of production. It is an encouraging feature that we are less proportionally dependent on the Americans than in 1843, and that our other sources of supply have to some extent kept pace with the rapidly-augmenting demand; but it is, nevertheless, a grave fact that the American cotton-fields sent us last year nearly double the quantity forwarded in 1843, and that any interruption in their production would now be felt on this side of the Atlantic more keenly than ever. Thus, in 1843 the American supplies were 574,738,520 lb.; in 1844, 517,218,622 lb.; in 1845, 626.650,412 lb.; in 1846, 401,949,393 lb.; in 1847, 364,599.291 lb.; in 1848, 600,247,488 lb.; in 1849, 634,504,050 lb.; in 1850, 493,153,112 lb.; in 1851, 596,638,962 lb.; in 1852, 765,630,544 lb.; in 1853, 652,451.796 lb.: in 1854, 722,151,346 lb.; in 1855, 681,629 424 lb.; in 1856, 780,040,016 lb.; in 1857, 654,758,048 lb.; in 1858, 833,237.776 lb.; in 1859, 961,707,264 lb.; and in 1860, 1,115,890,608 lb. The production of British India, which sustained a severe check in the year of the great mutiny (when it reached its *maximum*), is now again recovering. The receipts from India last year were 204,141,168 lb., as compared with 180.496.624 lb. in 1856; 250,338,144 lb. in 1857; 132,722,576 lb. in 1858; and 192,330,800 lb. in 1859. The receipts from the Mediterranean were last year 44,036,608 lb., a larger total than in any previous year, with the exception of 1852, when the supplies from that source were 48,058,640 lb. The value of the raw cotton imported last year was L.35,756,889, as compared with L.34,559,636 in 1859; L.30,106.968 in 1858; L.29,288,227 in 1857; L.26,448,224 in 1856; L.20,848.515 in 1855; and L.20,175,395 in 1854.

Piston Packing.—Mr Joseph Roberts, of Chester, engineer, has recently patented an improved piston, which is represented in the accompanying engravings. Fig. 1 is a side elevation, partly in section; and fig. 2 is a corresponding plan, with the junk ring or piston cover, removed to show the internal arrangement and construction. The working rings, *e*, which are turned accurately and ground to their places, have an inner V shaped annular ring, *f*, of an uniform size, cut in one or more places as required, into which a V wedge is inserted. The spring, *h*, which may be made of steel, cast or wrought iron, brass, or other suitable metal, is of an annular, square, triangular, or other suitable form, with any requisite number of screw studs, *i*, according to the size of the piston, having two nuts and a head on each, the spring to be between the two nuts, and the head behind the annular ring; the screw studs, *i*, acting against the ring, *f*, force the working rings, *e*, against the inside of the cylinder, so as to ensure a good and perfect fit, being at the the same time to follow up the wearing of the working rings, one of the studs, *i*, acting against the V wedge inserted into the slit. To put the piston in working order, the bottom working ring, *e*, being laid on the body of the piston, the annular V shaped ring, *f*, is next laid on (being cut in one or more places as required), the spring, *h*, is then put in, having the screw studs, *i*, placed radially, one against the V wedge, in case of being cut in only one place, as shown by the dotted lines at *k*, the rest behind the ring, *f*; the screw studs are then screwed outwards, forcing the ring, *f*, upward, and outwards a little. The top working ring is then put on the ring *f*, which will then be a little apart from the bottom working ring. On the cover being screwed down by the bolts, *d*, the top ring is forced down until it arrives at its proper position, as shown in the engraving, forcing the annular ring, *f*, into contact with the spring, *h*, more forcibly by the screw studs, *i*, fixed in the spring, causing the said spring to act as intended, giving

Fig. 1.



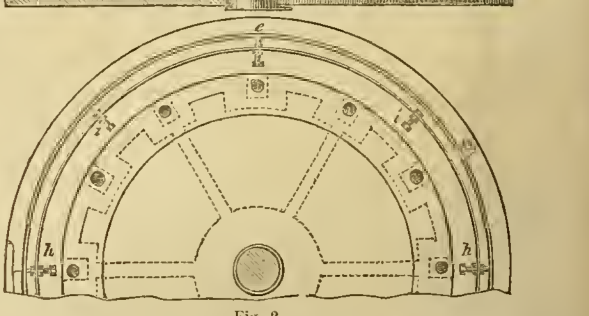
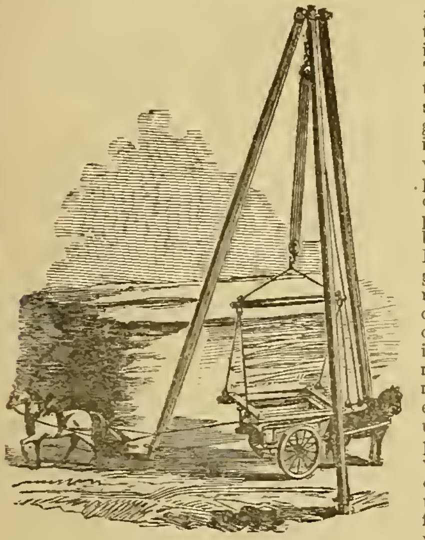


Fig. 2.

strength with perfect elasticity, and also being able to follow up the wearing of the working rings without losing any strength or elasticity, as is generally the case by the plans hitherto adopted.—The engravings were taken from a working piston of 60 horse power, and are reduced to one-third, from a two-inch scale drawing.

Hay and Corn Lift.—This lift is the invention of Mr Archd. White, of Great Missenden, Buckinghamshire. The apparatus consists of a tripod of poles, 45 feet in height, with a pulley and tackle suspended from the upper part, and terminating in a stretcher and slings. These slings are attached to the four corners of a frame, supported on a cart or waggon. The load of hay or corn is placed on the frame, and when brought under the tripod, the load is lifted at one operation by means of the pulley and tackle—a horse being used to raise the load. In this way manual labour is greatly economised, and the ricks may be built double the ordinary height, thus saving one bottom, top, and thatching. The load is very easily raised and suspended to the required height, and the men employed unload it in the usual way; but all overhead pitching is avoided, and the work is consequently rendered lighter and more profitable to the farmer. A carriage is furnished for the tripod-stand, which is easily set up with the assistance of a horse, and so moved from rick to rick, and taken down at the end of the harvest. By a slight modification, the body of the cart may be arranged so as to detach it from the axle and wheels, and so serve in lieu of the separate frame before alluded to. The apparatus may also be used for lowering hay when cut for trussing, or corn when being removed for thrashing, also for raising rick cloths. Its introduction is certainly a step in the right direction, and one, we have little doubt, which will be highly appreciated by agricultural men.



Clamp for Fire-Engine Hose.—The object of this ingenious apparatus is to close rents or fractures in fire-engine hose, flexible or compressible tubing, &c. Among the advantages it offers are readiness of application, and effectual and instantaneous prevention of loss of water or other fluid. It is patented here by Mr R. Dawharn of Wisbeach, Cambridgeshire, as a communication from the inventor, J. S. Mackay, Esq., of New York. It has been severely tested both in America, where steam is employed to work the fire-engines, and here, both by powerful hydrants and fire-brigades, and the result has been most satisfactory. The principle is capable of varied adaptations, so as to suit the vulcanized india-rubber and the patent linen hose, and also to leather hose with rivets. The clamp consists of three separate pieces of metal, indicated in the drawing by the letters A, B, and C. B and C are two plates fitting accurately upon each other, and to each is given the necessary concavity to suit the curve of the hose or pipe, D, to which it may be applied. From the centre of the lower plate, C, rises perpendicularly a screw, which, passing through the upper plate, B, enters a collar tapped to receive it. On turning the bent lever, A, which is attached to the collar, the two plates are brought into contact. When the clamp is applied, the lower plate, C, is inserted in the tube beneath the rent or fracture, and a few turns of the lever, H, are sufficient to effectually close the leak. The time required for its application, under ordinary circumstances, is less than a minute. In addition to its special utility to fire-engines, it is capable of application to other purposes, as in manufactories, breweries, ships, and wherever flexible piping is employed. In most of our larger towns water is supplied under very high pressure. The bursting of hose consequently is of more frequent occurrence—a length which otherwise must be removed, with great loss of time, can, by the immediate appliance of the clamp, be continued in use, and delay prevented. In agricultural districts, also, where the number of engines is small, and the length of hose is frequently inadequate, these clamps will be found an invaluable attendant. In many instances it will prove equal to a much larger supply of hose, and it will economize water, which is rarely abundant in the country in the autumn, when agricultural districts are most exposed to fires.

Fig. 1.

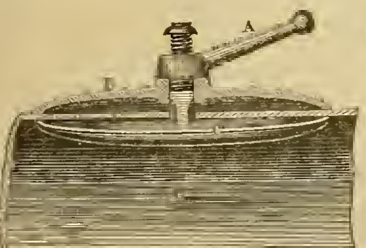
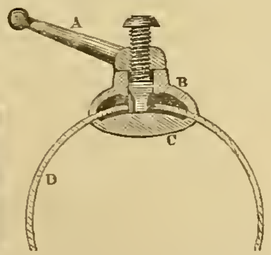


Fig. 2.



APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

8th May, 1861.

1161. Jean T. Massiaux, Nonzon, France—Improvements in the manufacture of nails, and in apparatus used thereby.

1162. Henry M. Nicholls, Essex Street, Strand—An improved instrument for withdrawing corks from bottles when acting as stoppers therein.

1163. Raoul Bernard, Bordeaux, France—Improved means of catching flies.

1164. Louis Wyttenbach and Philippe Lugand, Rue Caumartin, Paris—A life preserver in conflagrations.

1165. Joseph Fitter, Birmingham, Warwickshire—A new or improved table expander.

1166. John R. Hunt, Chichester place, Wandsworth Road, Surrey—Improvements in the manufacture of gutta percha and compounds thereof with other matters and substances.

1167. William W. Harrison, Sheffield, Yorkshire—Improvements in tea and coffee urns, coffee pots, and other vessels for similar purposes.

1168. Ebenezer Hoskins, Birmingham, Warwickshire—An improvement in joints for articles in metal.

1169. Philip H. Williams, Bristol—Improvements in the adaptation of plates of iron and other metal in the construction of dwelling houses, fences, parts of carriages or vehicles, and in other structures or constructions.

1170. Henry Swan, Hammersmith—Improvements in lubricating apparatus.

9th May, 1861.

1171. John Yeadon, Lancashire Hill, near Stockport, Lancashire—Improvements in the manufacture of healds.

1172. Charles Lenny, Croydon, Surrey—Improvements in carriages.

1173. George Carter, Blackburn, Lancashire—An improved thermometrical fire alarum and extinguisher.

1174. John Stewart, Glasgow, Lanarkshire—Improvements in the manufacture of cards for jacquard weaving.—(Communication from Louis J. Filliou, Grongis, Aisne, France.)

1175. Joseph Burch, Cragg Hall, near Macclesfield, Cheshire—Improvements in constructing and in machinery or apparatus for propelling ships and vessels.

1176. Ferdinand Stern, Cannon Street West—Improvements in fastenings for porte-monnaies, pocket-books, cigar-cases, and similar articles.(Communication from Seigmund Rothschild, Offenbach, Grand Duchy of Hesse Darmstadt).

1177. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the decoloration and disinfection of liquids, and in apparatus to be employed therein, which improvements are also applicable to the manufacture or production of drying oils.—(Communication from Louis Bouton, Paris.)

1178. Henry Cater, Southwark—Improvements in the construction of steam boilers.

1179. Isaac Merritt Singer, New York, U.S.—An improved feed motion for sewing machines.

1180. Hubert Allen, Birmingham, Warwickshire—An improvement or improvements in and applicable to gloves.

1181. John Browning, Minories, and William Crookes, Mornington Road—Improvements in spectrum cameras.

1182. John Paterson, Wood Street—An improvement in neck-ties.

10th May, 1861.

1183. Thomas Curtis, Livesey, near Blackburn, Lancashire—Improvements in the manufacture of healds.

1184. William Parsons, Scotland Street, Brighton, John Dowling, Gloucester Lane, Brighton, and John Dowling, yr., Gloucester Cottages, Brighton, Sussex—Improvements in railway and other passenger tickets.

1185. Thomas L. Jackson, Mile End—Improvements in furnace bars.

1186. Ludwig W. Roddewig, Sheffield, Yorkshire—Improvements in steam boilers.—(Communication from Frederick Schmidt, Hagen, Prussia.)

1187. Andrew Dunlop, Glasgow, Lanarkshire—Improvements in endless or portable railways for facilitating the traction or draught of vehicles.

1188. Alexandre L. E. Maulbon, Passage des Petites Equries, Paris—A tile manufacturing machine, being a contiguous turnplate system, the motion of which is intermittent.—(Communication from Jacques Félix, Beaulieu, near Epinal, France.)

1189. Stephen Barrett, Clifton Street—Improvements in projectiles.

1190. John F. L. Baddeley, Major R.A., Enfield—Improvements in bands for rifles and other fire-arms.

1191. Philip Vallance, Bolton Road, Abbey Road, St. John's Wood—Improvements in fire-arms and ordnance.

1192. Peter A. Godefroy, King's Mead Cottages, New North Road, Islington—The improvement in the treatment of india-rubber.

11th May, 1861.

1193. David Zenner, Newcastle-upon-Tyne—Improvements in purifying lead.

1194. Herman J. Sillem, Liverpool, Lancashire—An improved explosive shell.

1195. John Wareing, Salford, Lancashire—Improvements applicable to Ryder's forging machine which render it better adapted for forging mule spindles and articles of similar form.

1196. Henry J. Davies, Carlisle, Cumberland—Improvements in printing textile fabrics or materials.

1197. William Wilson, Conisbro', Yorkshire—Improvements in the manufacture of wooden keys and treenails for railways and shipping, and in machinery employed therein.

1198. Charles W. Lancaster, New Bond Street—Improvements in armour plates or bars for protecting ships and other structures, and in fixing the same.

1199. Richard A. Brooman, Fleet Street—An improved method of treating wood.—(Communication from Edmond A. L. D'Argy, Paris.)

1200. Auguste C. A G. de Meley, Paris—An improved treatment of natural phosphate of lime for several purposes.

1201. George F. Jones and James Jones, Yorkshire—Propelling and steering steam vessels, and for a casing about the propelling and steering apparatus, constituting therewith a steam condenser

1202. George F. Jones and James Jones, Yorkshire—An improvement in the form and in the construction of vessels, and of arched ribs for roofs and bridges with wrought iron plates, and in the method of uniting the plates together, and of the form of these.

1203. Humphrey Swindells, Handforth, Cheshire—Improvements in collars for horses.

1204 William H Tooth, Rhodeswell Road—Improvements in machinery or apparatus for reducing vegetable substances to a finely divided state, part of which improvements may also be employed for sifting or separating the fine from the coarse particles of other substances.

1205. William Clark, Chancery Lane—Improvements in the construction, ventilation, and propulsion of life-boats.—(Communication from John T. Scholl, Port Washington, Ozaukee, Wisconsin, U S.)

1206. William Clark, Chancery Lane—Certain improvements in machinery for planing lumber.—(Communication from Henry Dawes, Stover, New York, U.S)

13th May, 1861.

1207. Francis Puls, Francis Terrace, Hackney, Wick—A mode of preparing an oxidizing agent.

1208. Robert Heaton and James Stocks, Silsden, near Leeds, Yorkshire—Improvements in looms for weaving.

1209. John Bermingham, Cork, Ireland—Improvements in machinery or apparatus for breaking stones and other hard materials

1210. Pierre Chardemite, St. Georges de Didonne, France—An improved wind motive power engine.

1211. William Clark, Chancery Lane—Improvements in corking or stoppering bottles.—(Communication from Messieurs Edmond A. L. D'Argy, and Joseph J. P. L de Chabret du Rieu, Paris)

1212. George Betjemann, George W. Betjemann, and John Betjemann, Pentonville—An improvement in inkstands or ink holders.

1213. James Deakin, Harborne, Staffordshire—Improvements in and applicable to the manufacture of slabs, panels, and other forms or articles in paper or paper pulp.

1214. Thomas Bell, Usworth House, Gateshead, Durham—Improvements in the decomposition of the compounds of aluminum and in coating metals with aluminum or its alloys.—(Communication from Louis Le Chatelier, Paris.)

1215. Charles F. Pullard, Brompton Crescent—A sandal slipper particularly adapted for use in Turkish and other baths.

1216. Antoine C. Vautier, Charenton le Pont (Seine) near Paris Extracting new textile fabrics or fibrous matters of a silky or cotton nature, which can be applied to all fibrous matters.

1217. William Clark, Chancery Lane—The treatment of ammoniacal waters resulting from putrified urine, and from products extracted by the distillation of coal—(Communication from Messrs Louis J. F. Margueritte, and Alfred L. de Sourdeval, Paris.)

1218. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—An improved magic lantern, which the inventor terms a 'lampadoscope,' and views to be used therewith.—(Communication from Henri A. Lefevre, Paris)

1219. William Smith, Little Woolston, Buckingham—Improvements in implements and apparatus used when cultivating and tilling land.

1220 Charles Oliver, Old Boswell Court—Improvements in apparatus for sounding bells on lighthouses, floating lights, buoys, and like floating bodies.

1221. Richard Hornsby, Jun , Spittlegate, Grantham, Lincoln—Improvements in ploughs and other agricultural implements.

14th May, 1861.

1222. August F. Hildebrand, Köpnicker Strasse, Berlin, Prussia—Improvements in apparatus for propelling and steering carriages, which apparatus is also applicable for giving motion to machinery generally.

1223. William Clark, Chancery Lane—Improvements in the manufacture of steel.—(Communication from Louis J. F. Margueritte and Alfred L. de Sourdeval, Boulevart St. Martin, Paris.)

1224. Thomas C Bontet, John's Place, Brunswick Road, Camberwell—A new motor applicable to all branches of industry, and can also be employed for presses, scales, cranes. (The aerohydrolic motor).

1225. James Bullough and John Bullough, Baxenden, near Accrington, Lancashire—Improvements in looms for weaving, and in apparatus connected therewith.

1226. George S. Goodall, Brighouse, Yorkshire—Improvements in wire card covering for carding tow, flax, or other fibrous substances.

1227. Frederick Bull, London Wall—Improvements in show cases and boxes used in counting houses and by shopkeepers for containing different kinds of wares and papers or samples.

1228. Richard A. Brooman, Fleet Street—Improvements in working sugar refineries, and in sugar moulds and apparatus for trimming the loaves therein—(Communication from Jean B. J. Quéruel, Neuilly, France.)

1229. Robert W. Woollcombe, Stoke, Devonshire—Improvements in projectiles and in fire-arms for discharging the same.

1230. Jean J. L. Chazaren, Paris - Improvements in apparatuses for containing and drawing off beer and other malt liquor, and in drawing malt liquor from casks.

1231. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in apparatus for the manufacture of aerated waters, and in vessels or receptacles for containing the same—(Communication from Jean L André and Philippe F. Guillot, Paris)

1232. James Howard and Edward T. Bousfield, Bedford—Improvements in apparatus to be employed in steam cultivation.

1233. John Chedgey, Grove, Great Guildford Street, Southwark—Improvements in the manufacture of glass rollers, plungers, and pipes, applicable to pumps and other uses.

15th May, 1861.

1234. Alexander White and Malcolm Macdonald, Glasgow, Lanarkshire—Improvements in the manufacture of frills, ruffles, or frilled trimmings.

1235. Joseph Wooller, Bradford, Yorkshire—Improvements in machinery or apparatus for drying textile fabrics and materials, which improvements are also applicable in scouring or dyeing of the said materials.

1236. William Clark, Chancery Lane—Improvements in gas regulators.—(Communication from Emil Fleischhauer, Eisenach (Grossherzogthum Sachsen-Weimar-Eisenach), Germany.)

1237. Edward C. Kemp, Avon Place, Pershore Road, Birmingham, Warwickshire, and Thomas Hall, Basinghall Street, Leeds, Yorkshire—Improvements in gas and other lamps.

1238. John Riley, Hapton, near Accrington, Lancashire—Improvements in certain materials to be used in the process of dyeing and printing.

1239. William Mitchell, Manchester, Lancashire—Improvements in machinery or apparatus for printing paper hangings.

1240. Henry Doulton, High Street, Lambeth—Improvements in the construction of vats and similar vessels for containing liquids.

1241. Samuel C Lister and James Warburton, Manningham, near Bradford—Improvements in spinning and treating yarns.

1242. William E. Newton, Chancery Lane—Improved machinery for cutting chaff.—(Communication from Mr Rohrbeck, Bromberg, Prussia.)

1243. William Jackson, Leeds, Yorkshire—Improvements in mortising machines.

1244. James Hicks, Hatton Garden—An improved construction of self-registering thermometer.

16th May, 1861.

1245. Alexander T Watson, Middleton, Richmond, New York, U.S.—Springs for railroad cars and for carriages, and for many other purposes for which springs are used or required

1246 Frederic N. Gisborne, Adelaide Place, London Bridge—Improvements in the construction of electric targets for rifle and gun practice.

1247. Charles Stevens, Charing Cross—Improvements in mills.—(Communication from Jean Ellie, Rue Laffitte, Paris)

1248. William R. Bowditch, Wakefield, Yorkshire—Improvements in safety and other lamps.

1249. Henry Gilbee, South Street, Finsbury—An improved reaping machine to be called "comb beater."—(Communication from Napoleon Gorel, Bourges, France.)

1250. Alfred V. Newton, Chancery Lane—Improvements in knitting machinery.—(Communication from James G. Wilson, New York, U S.)

1251. George Knight, Nottingham—Improvements in holders and cases for holding bonnet fronts, rouches, frills, and other fancy articles.

1252. Charles Clay, Walton, near Wakefield, Yorkshire—Improvements in implements for cultivating land suitable to be worked by steam or other power.

1253. Daniel K. Clark, Adam Street, Adelphi—Improvements in furnaces.

1254. John L Bowhay, Modbury, Devonshire—Improvements in reaping and mowing machines.

1255. Bernard Hudson, Gloucester Crescent, Regent's Park—Improvements in the construction of power looms—(Communication from Francois L. Vermeersch, Brussels, Belgium.)

1256. Bernard Hudson, Gloucester Crescent, Regent's Park—An improved machine for applying steam in a manner to cause direct rotation.—(Communication from Messrs Grande, Olivieri, and Mongiardino, Turin, Italy.)

17th May, 1861.

1257. Thomas Dunn, Pendleton, Manchester—Improvements in watches and pocket time keepers.

1258. Thomas Dunn, Pendleton, Manchester—Improvements in machinery and apparatus for altering the position of locomotive engines, carriages, and goods, and preventing injury and accidents on railways.

1259. Samuel Tearne, Birmingham, Warwickshire—An improvement or improvements in producing designs in enamel on articles of brass, and the alloy called German silver.

1260. Samuel Pitts, Catherine Street, Strand—Improvements in billiard and bagatelle tables.

1261. Alexander Allen, Perth, Perthshire—Improvements in locomotive steam engines, and in buffer and draw springs for the same, and for other railway rolling stock.

1262. Jean C. M. Reziat, Rue Mouffetard, Paris—Improved apparatus for raising or tilting casks and other vessels or articles requiring to be tilted.

1263. George Davies, Serle Street, Lincoln's Inn and St Enoch Square, Glasgow, Lanarkshire—Improvements in advertising.—(Communication from Francois C. Gaillard, Paris.)

1264. Archibald Turner, Leicester—Improvements in the manufacture of elastic fabrics.

1265. William Paley, Jun , Lombard Street, and James Richardson, Brewer Street, Clerkenwell—Improvements in the manufacture of brushes.

1266. William Clark, Chancery Lane—Improvements in the preparation or manufacture of artificial alizarine.—(Communication from Francois Z. Roussin, Boulevart St Martin, Paris.)

1267. Peter Ashcroft, London Bridge Station—Improvements in railway chairs and fastenings.

18*th May*, 1861.

1268. William H. Bennett, Parliament Street, Westminster—Improvements in apparatus for regulating the supply of gas.—(Communication from Edouard Servier, Paris.)

1269. Archibald C. Ponton, Arlington Villas, Clifton, near Bristol—Combining together siliceous powder into solid masses of any form by means of sulphur, and which combination I call siliceous stoneware.

1270. George Neville, Birmingham, Warwickshire—Improvements in the construction of the sacking of bedsteads and couches, and other like articles.

1271. Samuel L. Sotheby, Buckfast Leigh Abbey, Devonshire, and Wellington Street, Strand—Improvements in the bindings or coverings of books and portfolios, which improvements may be applied to dispatch boxes, ladies' work boxes, office boxes, and such articles.

1272. John W. Greaves, Port Madoc, Carnarvon—Improvements in machinery or apparatus for dressing slates.

1273. Desmond G. FitzGerald, Cambridge Street—Improvements in obtaining electric currents for telegraphing purposes.

1274. Desmond G. FitzGerald, Cambridge Street—Improvements in batteries for producing voltaic electricity, together with certain metallic products.

1275. John Hughes, Newport, Monmouth—Improvements in plates to be used in ships and other structures for receiving armour plates or bars, and in the means of fixing such armour plates.

1276. Frederick O. Ward, Hertford Street, May Fair—Improvements in manufacturing manure and in obtaining accessory products.

1277. Robert King and Kenneth Robson, Granville Street, Sheffield, Yorkshire—Consuming and destroying smoke as emitted from engine or other chimneys, and from all other flues from which smoke is emitted.

1278. William Clark, Chancery Lane—Improvements in electric telegraph apparatus.—(Communication from Ludovic G. d'Arlincourt, Boulevart St Martin, Paris.)

1279. Benjamin F. Stevens, Trafalgar Square—Improvements in tracto-motives or engines for running upon earth or on common roads.—(Communication from Simon Stevens, Lancaster, Pennsylvania, U.S.)

20*th May*, 1861.

1280. William C. Forster, Gibson Street, Lambeth, Surrey—An improved method of manufacturing bricks and slabs, impervious to damp, for preventing moisture rising in pavements and the walls in houses and other buildings.

1281. George Buckley, Salford, Lancashire—Improvements in the construction of rollers for doubling frames and other machines.

1282 John Sidebottom, Harewood, near Mottram, Cheshire—Improvements in cop tubes and partial tubes, and in apparatus for holding them on to the spindles of mules for spinning and doubling, also improvements in the construction of the skewers for shuttles and winding machines.

1283. Joseph Jobin, South Island Place, Clapham Road, Surrey, and James Weber, St Martin's le Grand—Improvements in the manufacture of cigars and cigarettes, and in the apparatus employed in such manufacture.

1284. William Parkinson, Ripon, Yorkshire—Improvements in washing, wringing, and mangling machines.

1285. Michael Scott, Parliament Street, Westminster—Improvements in ordnance.

1286 George E. Donisthorpe, Leeds—Improvements in sizing, drying, and warping yarns for weaving.

1287. Andrew J. Robertson, Parliament Street, Westminster—Improvements in the construction of ships and vessels.

1288. Oswald Papengouth and Laurenz I. Lehmann, Blackfriars Road, Surrey—Improvements in propelling vessels.

1289 Edward Humphrys, Deptford, Kent—Improvements in the construction of iron ships, batteries, and forts.

21*st May*, 1861.

1290. Henry B. Barlow, Manchester—Certain improvements in looms for weaving.—(Communication from Hyppolite V. Hermite, Paris.)

1291. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the coupling or connecting joints of pipes for the conveyance of liquid, fluid, or solid bodies.—(Communication from J. B. Lavril, Paris.)

1292 George F. Griffin, New Adelphi Chambers, Adelphi—Improvements in the manufacture or construction of railway chairs and their fastenings, the latter being applicable to other purposes.

1293. William P. Dreaper, Bold Street, Liverpool—Improvements in pianofortes.

1294. Youngs Parfrey, Pimlico Wheel Works—Improvements in the construction of carriage wheels.

1295. Thomas Aveling and Henry Rawlinson, Rochester, Kent—Improvements in the construction of locomotive engines.

1296. William Tasker, Andover, Hants—Improvements in machinery or apparatus for tilling or cultivating land.

1297. Thomas Sykes and Benjamin C. Sykes, M.D., Cleckheaton, Yorkshire, and James W. Crossley, Yorkshire—Improvements in boilers and furnaces.

22*d May*, 1861.

1298. Joseph Bleasdale, Accrington, Lancashire—Improvements in the manufacture of fluted rollers for preparing and spinning fibrous materials, and in machinery for the purpose.

1299. Samuel P. Matthews, Monmore Green, Wolverhampton, Staffordshire—Improvements in door locks, lock spindles, and knobs.

1300. Jules R. Chesneau, Rue de l'Echiquier, Paris—Improvements in pen and pencil holders.

1301. Henry B. de Beaumont, Geneva—Improvements in ploughs.

1302. George E. Donisthorpe, Leeds—Improvements in apparatus used in getting coal.

1303 Giovanni B. Naglost, Vienna, Austria—Improvements in cannon and projectiles to be used therewith.—(Communication from Joseph Zöchling Vienna, Austria.)

1304. William E. Newton, Chancery Lane—Improvements in printing machinery.—(Communication from Stephen D. Tucker, New York, U.S.)

23*rd May* 1861.

1305. Levi Lumb, Brotherhood Mills, near Rochdale, Lancashire, and William H. Butterworth, Reed Hill, Rochdale, Lancashire—Improvements in undercovers of carding engines.

1306. Charles Nuttall, South Lane, Rochdale, Lancashire—Improvements in machinery for grinding the cards of carding engines, and in machinery for making the same.

1307. John Hynam, Wilson Street—Improvements in apparatuses for arranging splints for matches, and for placing them in the frames ready for dipping.

1308. William Tebbutt, Loughborough, Leicester—Improvements in ventilating rooms in buildings of every kind or description, and for carrying off the foul air from manufactories, hospitals, stables, or other places, and also the foul air produced by the combustion of gas, which said improvements, I call the double draught ventilating and condensing apparatus.

1309. Joseph H. Dart, Church Court, Clements Lane—Improvements in the manufacture of paper.

1310. Robert Mushet, Coleford, Gloucester—An Improvement or improvements in casting ingots of steel.

1311. Richard A Brooman, Fleet Street—Improvements in portable cooking apparatuses.—(Communication from Noel E. A. Paret, Paris.)

1312. Ebenezer Partridge, Smethwick, Staffordshire—An improved method of lubricating carriage axles.

1313. Henry M. F. J. V. de la Tour-du-breuil and Alexandre M. A. de la Tour-du-breuil, Boulevart St Martin, Paris—A copying press, so called telegraph press.

24*th May*, 1861.

1314. Charles Batty, Marylebone Road—Improvements in the mode of and apparatus for warming and ventilating rooms and buildings.

1315. Barnard Collingham, Keighley, Yorkshire, and Mark Mason, Manchester—Improvements in flyers employed in machinery for preparing and spinning fibrous substances.

1316. Frederick H. Danchell, Red Lion Square—Certain methods of ascertaining and removing impurities contained in water.

1317. Robert Joslin, King William Street—Improvements in gentleman's scarfs.

1318. George Herbert, Summer Hill, Dartford, Kent—Improvements in apparatus for striking bells.

1319. John Paterson, Wood Street—An improvement in clasps or buckles.

1320. Richard Preece, Clapham Road, Surrey—An improvement in floors.

25*th May*, 1861.

1321. Henry Waller, Lickhill, near Calne, Wiltshire—An improved horse rake.

1322. Edward H. C. Monckton, Regent Street—Obtaining and applying magnetic motive power, which invention also applicable to other useful purposes.

1323. William Roberts, Millwall—Improvements in vices and screw benches.

27*th May*, 1861.

1324. William Kay, Bolton-le-Moors, Lancashire, and Isaac Kay, Lever Bridge, near Bolton-le-Moors, Lancashire—Improvements in machines for spinning and doubling.

1325. Edwin Green and Joel Cadbury, Birmingham, Warwickshire—Certain improvements in buttons for general use.

1326. William Smith, James Lord and Henry Barlow, Green's Nook Mill, Lancashire—Improvements in looms for weaving.

1327. Thomas Moore, Southwark Bridge Road, Surrey—Improvements in apparatus for raising water and other fluids, which same apparatus may also be employed as a prime mover.

1328. Mathieu de Albytre, Bordeaux, Gironde, France—Improvements in tallow candles called Hilioclypse candles.

1329. Charles S. Duncan, Kildare Terrace, Bayswater—Improvements in the construction of electric telegraph cables or ropes.

1330. Lord A. S. Churchill, Rutland Gate, and Edward W. H. Schenley, Princes Gate—Improvements in buffing and coupling apparatus for railway carriages.—(Communication from Archibald H. Rowand, Allegany, Pennsylvania, U.S.)

1331. Joseph Lee and Benjamin D. Taplin, Lincolnshire—Improvements in the manufacture of portable or traction steam-engines, and in apparatus for cutting joints, heads of connecting rods, and other articles.

1332. William B. Holbeck, Thurlaston Lodge, Leicestershire—Improvements in apparatus for sowing seed.

1333. William N. Nicholson, Newark-on-Trent—Improvements in machines for making and collecting hay, and for collecting similar substances, parts of which improvements are applicable to cutting thistles and other weeds.

1334. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in apparatus for transmitting motive power.—(Communication from Francois Normand, Paris.)

28*th May*, 1861.

1335. Egbert R. Burnham, Liverpool, Lancashire—Improvements in the manufacture of boots, shoes, and other coverings for the feet, made of india rubber, gutta percha, and like substances.

1336. Philip A. Millward, Wednesbury, Staffordshire—Improvements in the manufacture of coke.

29th May, 1861.

1337. George W. Rendel, Elswick Ordnance Works, Northumberland—Improvements in the manufacture of wrought iron cylinders for the construction of ordnance.

1338. Robert M. Letchford, Old Montague Street—An improvement in the manufacture of matches.

1339. George Asher, Birmingham, Warwickshire—An improvement or improvements in the manufacture of metallic fenders.

1340. Henry Crichley, Birmingham, Warwickshire—Improvements in the manufacture and ornamentation of metallic chimney pieces or mantel pieces, and in the ornamentation of metallic stoves and fire places.

1341. Edward H. C. Monckton, Regent Street—Obtaining and applying magnetic motive power.

1342. John Halliwell, Baslow, Derbyshire—Improvements in churns.

1343. Comyn Ching, Castle Street, Long Acre—Improvements in gas chandeliers.

1344. Thomas Hale, Barnsbury Row, Park Road, Islington, and Arthur Wall, Canton Street, East India Road—Improvements in the construction and internal arrangement of furnaces, and in the preparation, manufacture, and treatment of clays, and of articles, surfaces, structures, and erections, subject to the action of fire or atmospheric influence.

1345. William E. Newton, Chancery Lane—Improvements in refining and purifying iron, and converting the same into steel.—(Communication from Ebenezer G. Pomeroy, New York, U.S.)

30th May, 1861.

1346. William B Rooff, Willow Walk, Kentish Town—An improved window seat, part of the invention being applicable to other purposes.

1347. William P. Savage, Roxham, Downham, Norfolk—Improvements in reaping and mowing machines.

1348. Francea A. Whitehead, Whitehead's Grove, Chelsea—Improvements in treating cream or milk, and in obtaining butter and other products therefrom.

1349. Charlea Garrood, Penge, Surrey—Improvements in horse rakes and harrows.

1350. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in apparatus for regulating the pressure of gas.—(Communication from Henri Girond, Paris.)

1351. Thomas Y. Hall and Joseph Stockley, Newcastle-upon-Tyne—Improvements in apparatus for communicating signals, applicable to railway trains and vehicles on land, and to vessels on water.

1352. James Ronald, Liverpool, Lancashire—Improvements in machinery for the manufacture of "topped up," "formed," or "laid" thread, twine, cord, line, cable, and other cordage.

1353. Alfred Blake, Russell Place, Fitzroy Square—Improvements in the process of brewing.

1354. Alphonse Oudry, Paris—An improved construction of suspension bridges.

1355. Louis Heinemann, Cannon Street West—An improved fastening for purses, reticules, bags, belts, bands, pocket books, cigar, writing, and instrument cases, and other similar purposes.—(Communication from Messieurs Stautz and Co., Offenbach, Germany.)

31st May, 1861.

1356. William Bywater, Leeds, Yorkshire—Improvements in means or apparatus for finishing and drying thread, twine, cords and ropes.

1357. Michael Henry, Fleet Street—Improvements in the manufacture of shirt fronts, and in producing fabrics or materials for the same.—(Communication from Jean H. Albigès, Boulevard Saint Martin, Paris.)

1358. William Hunter, Glassford Street, Glasgow, Lanarkshire—Improvements in looms for weaving

1359. Hugh B. Mackay, Knockmore House, Ballymoney, Antrim—Cleaning flax, separating the fibre from the straw, called a flax scutching machine.

1360. William E. Gedge, Wellington Street, Strand—Improved machinery for cutting stone of every description.—(Communication from Pierre Martiu, Lyons, France.)

1361. Richard A Brooman, Fleet Street—An improved apparatus to be applied to the shoes of horses and other shod animals to prevent them from slipping in frosty weather.—(Communication from Pierre Thiry, sen., Paris.)

1362. Frederick Tolhausen, Boulevart Bonne-Nouvelle, Paris—Improvements in revolving fire-arms.—(Communication from Michel Javelle, Rue Beaubrun, St. Etienne, France.)

1363. Edward C. Healey, Strand—Improvements in ordnance and fire-arms.—(Communication from Charles Alger, Newburgh, New York, U S)

1364. Ebenezer Hartnall, Ryde, Isle of Wight—An improvement in the manufacture of paper.

1365. George Glover, Queen Square, Westminster—Improvements in gas meters and pneumatometers.

1366. Paul Cameron, Glasgow, Lanarkshire—Improvements in instruments for measuring, indicating, and regulating the pressure or flow of fluids.

1367. Richard Laming, Priory Road, Kilburn—Improvements in manufacturing alkaline carbonates.—(Communication from Joseph M. Laming, Paris.)

1368. Charles Beauclerk, Riding Manor House, Northumberland—Improvements in propelling vessels.

1st June, 1861.

1369. Montague Wigzell, Friars Green, Exeter, Devonshire—An improvement in the form of iron, steel, brass, copper, and other metallic alloy for making nails, spikes, bolts, screws, and other similar driving articles, both plain and twisted.

1370. Michael Burke, Liverpool. Lancashire—Improvement in the manufacture of folding metallic chairs, bedsteads, and sofas, and other articles for sitting, lying, or reclining upon, a part of which improvements may also be applied to other articles of metallic furniture.

1371. Thomas Coradine, Glasgow, Lanarkshire—Improvements in machinery or apparatus for cutting or dividing metal or other sheets or plates.

1372. Robert Wilson, Liverpool, Lancashire—Improvements in anchors.

1373. George Watson, Commercial Road—Improvements in disengaging apparatuses for boats

1374. Jacob Taylor and Robert King, Oldham, Lancashire—Improvements in machinery or apparatus for preparing cotton or other fibrous materials to be spun.

1375. Paul Gondolo, Boulevart St. Martin, Paris—An improved kneading machine.

1376 Louis Bilon and Jean E. J Nappey, Boulevart St. Martin, Paris—An apparatus for manufacturing bricks and tiles.

1377. Howarth Stansfield, Back Drake Street, Rochdale, Lancashire—Improvements in punching machines.

1378. Frederic N. Gisborne, Adelaide Place, London Bridge—Improvements in the means of indicating the course to be steered in ships at sea and in galvanic batteries to be used in some cases therewith.

1379. Robert C. Ransome, Ipswich, Suffolk—Improvements in reaping and mowing machines.—(Communication from Thomas Robinson, Elizabeth Street, Melbourne, Australia.)

1380. William A. Shepard, Pall Mall—Improvements in steam boilers.

1381. Charles Garrood, Penge, Surrey—Improvements in cultivators and horse hoes.

1382. William A. Shepard, Pall Mall—Improvements in obtaining products from coal, and in apparatus employed therein.

1383. Thomas Ambler, Ingrow Paper Mills, Keighley, Yorkshire—Improvements in top rollers for spinning and drawing frames.

3d June, 1861.

1384. William Harwood, Stow Market, Suffolk—Improvements in reaping and mowing machines.

1385. Herbert Allman, Bedford Row—Certain improvements in the construction of castors for furniture.

1386. Herbert N. Penrice, Witton House. Norwich—Improvements in machinery for tunnelling and driving galleries through rock and other strata.

1387. William R. Jeune, Flower Terrace, Campbell Road, Bow—Improvements in the manufacture of kamptulicon.

1388. George B. V. Arbuckle, Charlton, Kent—Improvements in armour coating for ships, fortifications, and other structures.

1389. John Fowl, Plumstead, Kent—Improvements in propelling vessels.

1390. Joseph D. Davidge, City Terrace, Old Street Road—Improvements in the construction of arches or other curved structures made of brick, stone, or other materials.

1391. Oscar Muck. Bavaria—Improvements in machinery or apparatus for the manufacture of matches.—(Communication from Ottmar Walch, Paris.)

4th June, 1861.

1392. Marc A. F. Mennons, Rue de l'Echiquier, Paris—An improved combination of metals for the production of a white alloy resisting the action of vegetable acids.—(Communication from B. F. Trabuc, Nimes (dept. du Gard), France.)

1393. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the construction of miniature microscopes, and in the arrangement of the objects used therewith.—(Communication from Adolphe L. Chouippe, M.D., Paris.)

1394. Herbert Allman, Bedford Row—Certain improvements in the construction of window-sash fasteners.

1395. Stephen Hargreaves and Robert Holden, Helmshore, and Henry Holt, Newchurch. Lancashire—Improvements in machinery or apparatus for sizing warps or yarns;

1396. Henry H. Hazard, Nelson Terrace, City Road—Improvements in cartridges.

1397. Alexander Prince, Trafalgar Square, Charing Cross—Improvements in the manufacture of gas and in the apparatus connected therewith.—(Communication from Messieurs Schaeffer and Walcker, Berlin, Prussia.)

1398. John M. Stevenson, Prospect Place, Cheyne Walk, Chelsea—Improvements in the manufacture of boots and shoes.

1399. David W. Thomas, Liverpool, Lancashire—Improvements applicable to centrifugal machines.—(Communication from Jean A. Leon, Upper Egypt)

1400. William R. Floyd, Commercial Road East—An improved means of or apparatus for supporting knapsacks and packs.

1401. John Ford, Thames Iron Works, Blackwall—Improvements in ships' rudders.

1402. James L. Hancock and Frederick L. Hancock, Pentonville—Improvements in implements for pulverizing, ploughing, and grubbing land, and in applying motive power for working agricultural implements, parts of which improvements are applicable to condensing engines.

1403. Joseph H. Holdsworth, Wakefield, Yorkshire—An improvement in preparing, "crabbing," or finishing piece goods, and improvements in machinery employed therein.

1404. Anson Hubbell, Salisbury Street, Westminster—An improved apparatus to be used in washing clothes and other articles.

1405. Anson Hubbell, Salisbury Street, Westminster—An improvement in churns.

1406. Heinrich G. B. Roeber, Silvertown, Essex—Improvements in the manufacture of insulators for telegraphic wires, and in materials and machinery for coating telegraphic wires.

1407. Samuel Standfast, Hackney—An improved composition for building to be used in substitution for brick and stone, and an improved method of constructing walls and roofs for houses and other purposes.

1408. John A. V. Braam, New York—Improvements in constructing the barrels of fire arms and ordnance and in fire arms.

1409. John A Williams, Baydon, Wiltshire—Improvements in machinery or implements for cultivating land by steam power.

1410. Heinrich L. Buff, Osnabruck, Hanover—Improvements in the treatment of fatty and oily matters.

1411. Edward C. Stanford, Worthing, Sussex—Improvements in obtaining products from sea weeds.

5th June, 1861.

1412. Martin Dodsworth and William Smith, New Malton, Yorkshire—An improved boot and shoe-cleaning machine.

1413. Antonin Duguet, Newman Street—An improvement in the manufacture of pianos. —(Communication from Auguste A. Villaert, Rue de Chabrol, Paris.)

1414. Edmund Smith, Hamburg—Improvements in wet gas meters.

1415. Francois J. Manceaux, Paris—Improvements in breech-loading arms, and in projectiles for breech-loading arms.

1416. Oliver Chapman, Clerkenwell—An improved dressing and writing case.

6th June, 1861.

1417. John Baker, Oxford Street—The more perfectly finishing off and closing loaded cartridge cases used in breech-loading sporting guns.

1418. Daniel Nickols, Manchester, Lancashire—Improvements in machinery or apparatus for cutting paper or other materials.

1419. John Bailey and William H Bailey, Salford, Manchester, Lancashire—Improvements in apparatus for indicating the speed flow pressure and vacuum of liquids, fluids, and other bodies.

1420. Henry T. Coles, Silchester, Hants—Improvements in mechanism or apparatus for locks and bolts and other fasteners, gun locks, and gun breeches, catches for weaving shuttles, double screws, rifles, pistols, other fire arms and ordnance, weaving traversers, winders, sewing, weaving, netting, and other machines, and self-acting claws and grapplers.

1421. Leon J. P. de Mirimonde, Paris—Improvements in axle boxes, and in lubricating the parts therein.

1422. James Wright, Bridge Street, Blackfriars—Separating foreign matters from the droppings from carding machines and for returning the residue thereunto — (Communication from James Fitton, Cavendish, Windsor, Vermont, U.S.)

1423. Sampson Moore, Liverpool, Lancashire—Improvements in machinery or apparatus for dressing and polishing rice.

1424. Hugh Rigby and Peter W. Lowe, Salford, Lancashire—Improvements in the construction of steam boilers, and in the arrangement of the flues of steam boilers.

1425. Charles Stratford, Grooms Hill Grove, Greenwich, Kent—An equilibrium steering apparatus.

1426. George Baker, Birmingham, Warwickshire—A new or improved instrument or apparatus for churning and for beating eggs, and for other like purposes.

1427. Thomas Hamilton and James Hamilton, Glasgow, Lanarkshire—Improvements relating to cop tubes.

1428. Jesse Rust, Carlisle Street, Lambeth, Surrey—Hardening and preserving stone.

1429. Henry Turner and Thomas Yates, Leicester—Improvements in the manufacture of elastic web.

1430. Samuel Hawkins, John Street, Kingsland Road, N.E.—Improvements in expanding tables.

1431. Henry Turner and Thomas Yates, Leicester—Improvements in railway signals.

1432 William O. Johnston, Newcastle-upon-Tyne—Improvements in pillars for supporting the roof in coal and other mines.

1433. Benjamin D. Godfrey, Milford, Massachusetts, U.S.—An improved boot or shoe with leather uppers and india-rubber soles.

1434. Samuel C. Lister and James Warburton, Bradford, Yorkshire—Improvements in treating spinning and doubling yarns.

1435. Edward Hewett, St. Leonards on Sea, Sussex—Improvements in apparatus for creating or increasing air draughts in flues or other channels for ventilation and other purposes.

436. Alfred Smith, Hull, Yorkshire—Improvements in drying, sweetening, purifying, and otherwise improving wheat and other grain.

1437. John Platt and William Richardson, Oldham, Lancashire—Improvements in machinery or apparatus for making bricks.

1438. William E. Newton, Chancery Lane—Improvements applicable to railways for the purpose of facilitating the transport of carriages containing goods and passengers across arms of the sea, rivers, lakes, or inland waters.—(Communication from Monsieur M. de Bassilan, Paris.)

1439. John Platt and William Richardson, Oldham, Lancashire—Improvements in machinery or apparatus, commonly called "gins," for cleaning cotton from seeds.

7th June, 1861.

1440. William Riddle, Basford Street, Islington, and Henry G. Coombs, Union Street, Southwark—Improvements in shops.

1441. John Vaughan, Middlesborough-on-Tees, Yorkshire—Improvements in the manufacture of railway sleepers.

1442. Robert Harlow, Heaton Norris, Lancashire—Improvements in the fire bridges and tubes of steam boilers, and in the manner of applying the same.

1443. Hyppolite A. Balsac, Paris—An improved electro-thermometrical alarum.

1444. John Leeland, Birmingham, Warwickshire—An improvement or improvements in the sacking of bedsteads and couches and other articles used for sitting, lying, or reclining upon.

1445. Henri De Simencourt, Corbyn's Hall, near Dudley, Worcester, and John K. Blackwell, Gloucester Terrace, Hyde Park—Improvements in reverberatory and other furnaces.

1446. Samuel Bennett, yr., Handsworth, Staffordshire—An improvement or improvements in utilizing waste or defective pieces of tubing made of iron or of other metal or metallic alloy.

1447. William Wood, Shibden, near Halifax, Yorkshire—Improvements in looms for weaving.

1448. Alexander A. Croll, Coleman Street—Improvements in the manufacture of sulphate of alumina.

1449. Edward A. Cowper, Great George Street, Westminster—Improvements in protecting ships of war and land batteries from the effects of projectiles.

1450. William Leopard, Hurstpierpoint, Sussex—Improvements in railway brakes.

1451. Richard L. Cole, Minerva Place, Kennington Road, Surrey—An improved manufacture of glove for currying horses and other cattle.

1452. Charles W. Lancaster, New Bond Street—An improved method of sheathing ships and vessels with copper and other metallic sheathing.

1453. John F. Clarke, Moorgate Street—Improvements in apparatus for regulating the supply of flues.

1454. William A. Sands, New York, U.S.—Improvements in the construction or manufacture of sails for ships or other vessels.

8th June, 1861.

1455. John Whines, Pimlico—Improvements in double action box spring hinges for swing doors.

1456. William Robertson, Manchester—Improvements in the manufacture of drawing and delivering rollers used in preparing and spinning fibrous materials.

1457. Henry Du Mont, Rue de Rivoli, France—A photographic apparatus, having for object to reproduce the successive phases and shiftings of a motion.

1458. John M. Worrall and Thomas Lawrence, Ordsall, Lancashire—Certain improvements in machinery or apparatus for brushing, raising, and dressing the surfaces of cut-pile and looped fabrics.

1459. Robert M. Latham, Fleet Street—An improvement in hooped or hooped skirts.—(Communication from John C. Kelley, Canal Street, New York, U.S.)

1460. John Mason, Nottingham—A woollen article as a substitute for a sponge.

1461. James Howard and Edward T. Bousfield, Bedford—Improvements in haymaking machines.

1462. Joseph Roman, Liverpool, Lancashire—Improvements for economizing fuel in evaporating and concentrating, chiefly applicable to the manufacture of chemicals.

1463. Patrick O'Hanlan, Kingston-upon-Hull—Improvements in marine and land steam boilers.

1464. Juliana Martin, Myrtle Hall, Sidmouth, Devonshire—An improved ironing stove.

1465. James Rymer, Avenue Road, Regents Park—Improvements in the permanent way of railways.

1466. John Hutchison, Appleton Lodge, Widnes, near Warrington, Lancashire—Improvements in the treatment of wool.

1467. James McKay, Glasgow, Lanarkshire—Improvements in apparatus or means for cleaning chimneys or flues.

1468. William Clark, Chancery Lane—Improvements in the manufacture of a material or composition for cleaning and polishing metals and glass.—(Communication from Alexandre Cochet, Boulevart, St. Martin, Paris.)

1469. William Clark, Chancery Lane—Improvements in constructing casks, tubs, and other like vessels, whereby to render them watertight.—(Communication from Louis D. Frannin, Boulevart St. Martin, Paris.)

10th June, 1861.

1470. James Whitehead, David Street, Manchester—Certain improvements in looms for weaving.

1471. Auguste L C. de Montagu, Rue Ste. Appoline, Paris—A cone preventing smoke and extinguishing fires in chimneys.

1472. Robert Armstrong, North Woolwich—Improvements in marine steam boilers, parts of which improvements are applicable to other steam boilers, and in apparatus connected therewith.

1473. Andrew Brown, Waterloo Road, Liverpool, Lancashire—Improvements in obtaining fresh water at sea by means of distilling apparatus combined with the cooking stoves or otherwise.

1474. David Rollo, Liverpool, Lancashire—Improvements in valves for steam and other engines.

1475. William Weller, Mile End—Improved apparatus for supplying fuel to furnaces, preventing or consuming smoke, and economizing fuel.

1476. John Oldroyd, Dewsbury, Yorkshire—Improvements in combining or mixing various colours of wool or other fibrous substances in the preparation of yarns for textile fabrics.

1477. Mark Mason, Manchester—Improvements in flyers and spindles of machinery for preparing, spinning, and doubling fibrous substances.

1478. William Crofts, Lenton Terrace, Park Side, Nottingham—Improvements in means or apparatus employed in the manufacture of fabrics by lace machinery.

1479. Charles F. Whitworth, Moses Gate, near Bolton, Lancashire—Improvements in means or apparatus employed in signalling on railways.

1480. John Langdale, Jun., South Stockton-on-Tees, Yorkshire—An improved washing machine.

1481. James Steart, St. James' Road, Blue Anchor Road, Bermondsey, Surrey—Improvements in treating skins for the manufacture of leather.

1482. Michael Hawdon, Blaydon, Durham—Improvements in apparatus for constructing moulds for casting metals.

1483. Robert Romaine, Devizes, Wiltshire—Improvements in machinery applicable to steam cultivation.

1484. Cromwell F. Varley, Fortess Terrace—Improvements in electric telegraphs.

1485. John B. Carter, Wilford Road, Nottingham—Improvements in apparatus used in dressing lace or other fabrics.

1486. Michael Henry, Fleet Street—Improvements in fire-arms.—(Communication from Pierre J. Jarre, Boulevart Saint Martin, Paris.)

11th June, 1861.

1487. Francois E. Schneider, Rue Gaillon, Paris—Improvements in breech-loading fire arms.

1488. Charles Stevens, Charing Cross—Improved crushing and pulverising machine.—(Communication from Adolphe J. Canu, Rue Laffitte, Paris.)

1489. Charles Stevens, Charing Cross—Improved impermeable varnish for leather.—(Communication from Joseph Chapu and Ernest Lacaze, Rue Laffitte, Paris.)

1490. Thomas O. Small, Newcastle upon Tyne—Improved optical instrument for the use of designers and others, to be called the "Polyeidoscope."

1491. Patrick M. Crane, Athy, Ireland—Improvements in the manufacture of peat fuel.

1492. James D. Harding, Barnes, Surrey, and William H. Winsor, Rathbone Place—Improvements in drawing materials and apparatus for the use of artists.

1493. Edward T. Hughes, Chancery Lane—Improvements in extracting oil from seeds, and in machinery or apparatus employed therein. — (Communication from Johann G. Hofmann, Breslau, Prussia)

1494. Charles Cheyne, Great George Street, Westminster—An improved method of constructing safety rifle and other gun "ranges."

1495. Robert W. Smith, and Daniel Scattergood, Nottingham — Improvements in machinery for manufacturing looped fabrics.

1496. Samuel B. Singer, Southsea, Southampton—An improvement in the card of compasses.

1497. Charles Chalmers, Edinburgh, Mid Lothian—Improvements in gas stoves.

1498. William E. Newton, Chancery Lane, Middlesex—Improvements in gunstocks — (Communication from Charles R. Alsop, Middleton, Connecticut, and Joseph W. Alsop, and Henry Chauncey, junior, New York, U S.)

12*th June*, 1861.

1499. William H. Walker, Liverpool, Lancashire—A floating hydraulic lift stage for raising navigable vessels or other heavy bodies above the surface of the water, and an improved method of "blocking" or "shoreing up."

1500. John A. Dauncey, Bury, Lancashire—Improvements in apparatus for supplying liquid nourishment to infants and invalids, and in the application of such improvements to the feeding of other animals.

1501. John Hope and William Greenhalgh, Bedford, Lancashire—Certain improvements in machinery or apparatus for cutting turnips, roots, or other substances.

1502. William E. Gedge, Wellington Street, Strand—An improved reaping and mowing machine.—(Communication from Victor E. D. Duchataux, Maretz, France.)

1503. Jean A. Callaud, Nantes, France—Improvements in the construction of electrical piles.

1504. James Durrant, Fitzroy Square, and Noel A Harris, Bayswater—Improvements in the form and construction of chimney tops or appliances for surmounting chimneys in order to regulate the up currents and prevent the down draughts.

1505. Hugh Mason, Ashton-under-Lyne, Lancashire—Improvements in machinery or apparatus for preparing and spinning cotton or other fibrous materials.

1506. Louis J. J. Petre, Boulevart St Martin, Paris—A smoke-consuming grate.

1507. John Watt, Westmoreland Place, Camberwell, Surrey—An improved mode of converting vegetable fibrous substances into pulp.

1508. Joseph Drew, Belgrave Terrace, Weymouth, Dorsetshire—Improvements in the adaptation of plates or shields to fixed and floating batteries, and also ships for the purpose of more effectually resisting shot or other projectiles.

1509. George Cox, Victoria Terrace, Queen's Road, Holloway—An improved floor dog or cramp.

1510. John Napier, Edinburgh, Mid-Lothian—Improvements in stereotyping.

1511. David Walmsley and John Rostron, Disley, Cheshire—Improvements (partly for the purpose of preventing accidents) applicable to hoisting machinery used in mills, warehouses, and other places.

1512. Robert Jobson, Dudley, and Cromwell F. Varley, Fortess Terrace, Kentish Town —Improvements in posts or supports for telegraph wires.

1513. Jean P. Girard, Countances, France—An improved coffee-mill.

13*th June*, 1861.

1514. Charles Swan, College Hill—An improved form of travelling bags.

1515. William E. Gedge, Wellington Street, Strand—Improved beating apparatus for picking and cleaning substances used in making or manufacturing woven or textile fabrics, more especially cashmeres, alpacas, and other fine materials, preparing the same for scouring. — (Communication from Michel Girres, Bazeilles, near Sedan, the Ardennes, France.)

1516. Etienne Chatonet, junior, La Rochelle, France—A machine to perfection easily opened covers for tin boxes or cases for packing sardines or other provisions

1517. Henry Holland, Birmingham, Warwickshire—An improvement in the manufacture of umbrellas and parasols.

1518. John Knowles, Bolton-le-Moors, Lancashire—Certain improvements in machinery for preparing cotton and other fibrous materials.

1519. Edward Bing, Ramsgate, Kent—Improvements in the construction and fittings of sliding window sashes.

1520. Jonas Illingworth, Bradford, Yorkshire—Improvements in arranging sizing houses, brew-houses, dye-houses, and other houses and chambers, to facilitate the removal of steam set free therein, also in the construction of troughs for sizing cotton warps, and in boxes or other receivers for holding such sized cotton warps.

1521. Francis Gregory, Manchester, Lancashire—Improvements in machinery or apparatus for cutting hay and chaff or other similar purposes.

1522. Samuel Cook and William H. Hacking, Bury, Lancashire—Improvements in machinery or apparatus for plaiting or folding woven fabrics.

1523. The Honorable Cecil Duncombe, Camelford House, Hereford Street, Park Lane—Improvements in machinery for sawing wood and other substances.

1524. Bewicke Blackburn, York Buildings, Adelphi—Improvements in applying oil or lubricating fluid to locomotive and other axletrees.

1525. Thomas M. Downing, Handsworth, Stafford — Certain improvements in the manufacture of corks and bungs.

1526. William Bayliss, Monmore Green, Wolverhampton, Stafford—Certain improvements in chain-harrows for harrowing land.

14*th June*, 1861.

1527. William C. Thomas, Wells Street, Oxford Street—Improvements in metal casing or armour for the defence of ships and batteries.

1528. John Summerscales, Keighley, Yorkshire, and Mark Mason, Manchester, Lancashire—Improvements in gas singeing apparatus.

1529. James Leeming, Manchester, Lancashire—Improvements applicable to steam boilers, furnaces, and flues.

1530. Albert F. Johnson, Boston, Massachusetts, U.S.—Certain new and useful improvements in machinery for sewing cloth or other material,

1531. Pierre Langlade, Aubusson (Creuse)—Improvements in the manufacture of tapestry and other weavings.

1532. Thomas W. Wedlake, Hornchurch, Essex—Improvements in haymaking machines.

1533. George Leach, Leeds, Yorkshire—Improvements in implements for tilling and cultivating the soil, and in boilers for supplying steam to engines for driving the same, which latter improvements are applicable to boilers generally and especially to boilers of traction engines.

15*th June*, 1861.

1534. Howard J. Kennard, Great George Street, Westminster—Improvements in the means of excavating sand and gravel under water.

1535. Robert W. Pitfield, Bolton, Lancashire—Certain improvements in self acting mules for spinning cotton and other fibrous substances.

1536. Thomas Knowles, Peter Aldred, Manchester, and John Haworth, Salford, Lancashire—Improvements in machinery or apparatus for raising serrated surfaces on rollers.

1537. Stephen Barnwell, Jun., Warwickshire—An improvement or improvements in the manufacture of upholsterer's fringes.

1538. Stephen Grant. St. James's Street, Westminster—Improvements in breech-loading fire arms and fowling pieces.

1539. Ferdinand Potts, Lombard Street, Birmingham, Warwickshire—Certain improvements in the manufacture of metallic posts for supporting telegraph wires, and which said improvements are also applicable for other purposes.

1540. William Smith, Little Woolstone, Bucks—Improvements in machinery for giving motion to ploughs, cultivators, and other agricultural implements.

1541. Thomas Page, Middle Scotland Yard, Westminster—Means and apparatus for facilitating the working and discharge of ordnance placed below the water level.

17*th June*, 1861.

1542. Hortensius C. Simpson, Shrewsbury, Salop—A new or improved vehicle or car.

1543. Thomas Gray, Hills Cottages, Union Road, Wandsworth, Surrey—An improved method of bleaching coloured rags and vegetable fibres.

1544. Samuel R. Smyth, Dover, Kent—A new or improved steam boiler.

1545. David B. White, Newcastle-upon-Tyne—Improvements in plummets and gauges for indicating the depth and the height or level of liquids.

1546. Joseph Lewis, High Street, Bloomsbury—Improved machinery for cutting and boring wood and other substances.

1547. Thomas Mellodew, Oldham, Charles W. Kesselmeyer, Manchester, and John M. Worrall, Salford, Lancashire—Improvements in dyeing and printing velvets, velveteens, and other fabrics with floated threads.

1548. Thomas Routledge, Eynsham Mills, near Oxford—Improvements in the manufacture of paper.

1549. William Clark, Chancery Lane—Improvements in the manufacture of letters, designs, and other articles of mica variously coloured or metallized.—(Communication from Thomas Lamie-Murray and Holthausen, Brothers, Boulevart St. Martin, Paris.)

1550. William Clark, Chancery Lane—Improvements in batteries, and in breech-loading ordnance and projectiles for the same.—(Communication from Mathieu Castay, Boulevart St. Martin, Paris, and Baron H. de Riviere, France.)

1551. John Perry, Earle Street East, Marylebone—Improvements in washing machines.

1552. William and Jacob Todd, Heywood, Lancashire—Certain improvements in power-looms for weaving.

18*th June*, 1861.

1553. Alphonse René Le Mire de Normandy, Odin Lodge, Kings Road, Clapham Park, Surrey—Improvements in refrigerating the fresh water produced by condensing steam.

1554. James Banks, Salisbury Street, Adelphi—Improvements in electro-magnetic telegraph printing apparatus or marking instruments.

1555. James Miller, Greenwich, Kent, and Henry E. Skinner, Wapping Wall, Shadwell —Improvements in rotary engines.

1556. Ferdinand Ziffer, Vienna, Austria—Certain improvements in carding engines for carding cotton and other fibrous substances.

1557. Robert Walker, Glasgow, Lanarkshire—Improvements in propelling vessels.

1558. Richard Fell, Great Saint Helen's—Improvements in obtaining motive power.

1559. William B. Taylor, Balmes Road—Improvements in heating by means of lamps, and in imparting heat to vessels and their contents, also applicable to cooking and to other purposes.

1560. William Fleming, Edinburgh, Mid Lothian—Improvements in machinery or apparatus for manufacturing snuff.

1561. Stephen Sharp, Birmingham, Warwickshire—Certain improvements in printing machines and in apparatus for taking off and delivering the sheets when printed, and which said apparatus is applicable to printing machines now in use.

1562. Andrew W. Gibson, Belfast, Antrim—Improvements in mills for the manufacture of barley and rice.

1563. James Dunn, Preston, Lancashire—Improvements in machinery or apparatus for slubbing, roving, spinning, twisting, and doubling cotton and other fibrous substances.

1564. James A. Limbert, Woodville Terrace, Gravesend, Kent — Improvements in mounting and fitting ships' guns and other ordnance.

1565. William E. Newton, Chancery Lane — Improved apparatus for transmitting motion.—(Communication from William Sellers and Coleman Sellers, Philadelphia, U.S.)

1566. Murdock M'Kay, Birmingham, Warwickshire—An improvement or improvements in the manufacture of cements or adhesive solutions for joining or connecting together surfaces or articles of leather, wood, paper, or other similar materials.

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

V.

The verdict in the case of Pymm *v.* Great Northern Company, proves that recent legislative enactments have at last made the responsibility of railway companies for the accidents which happen on their lines of a real serious character. This strikes us as being as it should be; and it is to be hoped that now the public will be no longer exposed to be frightened out of its propriety by the constant occurrence of these *unaccountable* misfortunes, which a very little care and attention might, in almost every instance, have avoided. In fact, the great source of danger in these cases arises from the very slovenly way in which the duties connected with the inspection and repairs of the roadway, and of the rolling stock, are performed; and the directors and shareholders of railway companies evidently require some forcible lessons to convince them that the fearful powers they exercise over life and limb are not to be trifled with. Amongst our neighbours, the managing director of a railway is made personally responsible for any accident which may occur, in addition to the pecuniary responsibility of the company; and from practical knowledge we can assure our readers that the system works well. The heavy damages given in the case of Mrs Pymm and family may, perhaps, produce the same effect here; but it is to be feared that this indirect responsibility, divided as it is over so many individuals, will hardly produce any very personal present action upon the servants of the companies.

The accident at the Clay Cross Colliery seems to have been of another category to the railway accidents referred to; for in truth it would seem that no blame was to be attached to the directors, or to the managers of the pit. The carelessness, and utter absence of system, of the former generations of miners, have indeed sown the chances of danger from inundations with great profusion, and instances of accidents of precisely the same description as this one at Clay Cross are only too common. Decidedly opposed as we are to anything like State intervention in any industrial operations, we cannot refrain from saying that a compulsory registration of the plans of underground workings is absolutely necessary. Nevertheless, it seems strange that men accustomed all their lives to work in certain mines should not be able to detect a difference in the sound of rock in its normal state, and that of the same rock when it only forms a thin division against a large body of water. It is idle, however, to speculate on these matters; and all that remains for us to do is to express the hope that at least the mining inspectors will enforce the regulations for recording the operations of the miners of the present day. There can be no reason why these men should continue to be exposed to be drowned, like so many rats in a hole, through the carelessness or the selfishness of indifferent owners in providing plans of their underground workings; and every person deriving profit from a mine is bound to exercise as much caution to prevent the irruption of water from old workings as a railway company is bound to prevent such accidents as the fall of the Wooton Bridge, or the roasting of a racehorse. After all, the absence of a general system, and of a Governmental control over great industrial operations, produces at times evils of so serious a nature that it would be absurd to push the theory of the freedom of industry to its logical consequences in such cases. It is often true that *summum jus est summa injuria;* and at all times the great employers of labour in mining operations, as well as the directors of railway companies, require to be taught that, if they have rights, they also have duties, and that some means must be devised to ensure the execution of the latter.

The statements lately made by the Duke of Somerset, and other persons connected with the Admiralty, with respect to the penetrating powers of the Armstrong shots, certainly disturb all previously formed opinions on the subject; and if they prove anything, it is that long and careful studies must still be made, before opinions of value can be formed on the system to be adopted in the construction of the "fleet of the future." No sooner had our authorities arrived at the conclusion that iron plates 4½ inches in thickness were sufficient to render a ship invulnerable, than an improvement in projectile weapons is made, by means of which plates even ten inches thick are transpierced! Where is all this to end? Are we to build ships of iron so thick as to allow bullets to embed themselves in their sides? Can we do so? Or are we to indulge the millennian dream that destructive weapons will ultimately be so perfected as at last to make men avoid war altogether? "It were a consummation devoutly to be wished!" For our own parts, we confess that the past history of the Armstrong guns has not been such as to induce us to receive implicitly the tales lately recorded by the Duke of Somerset with respect to their power, and we should be sorry to observe that the Admiralty relaxed in its efforts to endow the nation with an efficient fleet of iron-cased war steamers. As to the proposition for applying an iron case to old cut down wooden ships of the line, we hold it to be so monstrously absurd as not even to merit criticism.

The Report of the Commissioners, upon deep sea lines of telegraph, displays a sad tale of the recklessness, the carelessness, and the jobbery, which hitherto have disgraced and impeded the progress of this marvellous invention. It appears that out of 11,364 miles of submarine telegraph already laid, only 3000 miles, in round numbers, are actually in work. Of the total length, moreover, 3074 miles of line were laid in water of less than 100 fathoms depth, the remaining 8290 miles were the only ones correctly called "deep sea" lines. Of these, the Red Sea line of 3400 miles, and the Atlantic telegraph, of 2200 miles, have been total and utter failures, whilst the Java and Singapore line, the Sardinia, Malta, and Alexandria line, have been nearly as unfortunate. Every practical and theoretical mistake which could have been brought to bear on the question of the success of this system, from the use of hemp to protect the gutta percha coating, to the wilful employment of defective wires, seems to have been tolerated—every form of selfish peculation, of private immorality and malice, seems to have been exercised in this case—and it is even to be regretted that the Commissioners should have been so mild, as they actually have been, in the phrases they have applied to the parties who have been guilty of so much incompetency and immorality. The whole story is a disgraceful one to almost everybody who has been connected with deep sea telegraphy.

The Commissioners allude, as was above stated, to the mistake which was made in the case of the wire sunk at the Dardanelles, in covering the gutta percha with hemp; because the *teredo navalis* had attacked the last-named material; and we now draw attention to this observation on account of some recent observations made upon the habits of those destructive animals. It has hitherto been considered that the teredo would not attack wood which had been soaked with creasote; and persons connected with hydraulic works in England have looked upon that substance as an effectual defence to their wood-work, exposed to the ravages either of the *teredo* or of the *limnoria terebrans.* From personal observation we are disposed to doubt the efficacy of the protection afforded in the latter case; but in the last number of the "Annales des Ports et Chaussees," we observe that some cases have recently occurred in France, which would appear also to show that creasote is equally impotent against the teredo. The Dutch Government have lately named a Commission to inquire into the subject, and a preliminary report has been issued by them. Whilst the public are waiting for the sequel to this report, would it not be as well for English engineers to take the inquiry in hand? The property affected by the ravages of these minute enemies is of sufficient importance to challenge the most earnest investigations of all who are interested in mechanical or mercantile pursuits, in ships, or in dock, or pier property; if telegraph wires also are to be exposed to these ravages, it simply becomes the more necessary to know the nature of, and the remedy for the evil. It may be added, that the establishment of a new telegraphic line between Ajaccio and the mainland of France, proves that at least the French Government is not disposed to abandon the system, notwithstanding the failures above recorded.

Before leaving this subject of the deep-sea telegraphs, it may be a matter of interest to some of our readers to call attention to a serious and hitherto neglected source of danger to the lines, from the possible occurrence of submarine volcanoes. On the banks of the Red Sea, a new point of outburst has lately been established, and the mountain called the Jebel Dubbah, on the 8th of May last, broke into sudden activity, after many years' quiescence. Accidents of this kind are by no means rare; and such seas as the Mediterranean, the Red Sea, the Indian Archipelago, and the Gulf of Mexico, must especially be exposed to them. It is to be feared that should they occur, no human precautions could avail to secure a cable sunk in those seas.

But the saddest tale of all, "the moving accidents by flood and field," which have lately taken place, is the one connected with the fire at Cotton's Wharf, in which poor Mr Braidwood lost his life. Such a man must at all times have commanded the regrets of all who had known him; but the manner in which he closed his long and useful career, has greatly increased the public sympathy for his surviving relatives. Whilst thus paying honour to one so worthy of it, the duty of a professional journalist is, however, equally to attempt to draw from the event the practical lessons it is able to afford, with a view to the future prevention of calamities of such magnitude as the one in question. Now, the first of these lessons is, after all, only a confirmation of Mr Braidwood's own opinion, namely—that no building should be allowed of a cubical capacity able to support a fire so great as to be beyond control; and to a certain extent it has been acted upon in the last Metropolitan Building Act, which provides that no single building of more than 216,000 cubic feet should be erected. But the same Act allows that any two buildings of that capacity may be put in communication with one another, provided the openings were of a certain size, and able to be closed by double iron doors. It was the latter indulgence which seems to have contributed fatally to the intensity of the fire at Cotton's Wharf, for the men, in their fright, forgot to close the doors of communication, and thus the fire was enabled to seize hold of so large a volume of combustible matter as to render all human means for its extinction, of no avail. Whatever may be the limit of space tolerated in any one building, it seems, therefore, to us proved that it should never be allowed to be exceeded, and that all palliatives, in the shape of double doors, are practically worthless. The second lesson to be drawn from this fire is, that the decision lately arrived at by one of the London magistrates, according to which, it would be legal to construct warehouses, in which each storey might contain 216,000 cubic feet in capacity, provided the access to each of them were distinctly separated, and of an incombustible nature—that decision seems likely to be productive of serious evil. If, for instance, a series of warehouses, constructed on this principle was built, and the various stories filled with goods, such as were collected at Cotton's Wharf, a fire taking place in one of them would infallibly destroy the whole series; for it is to be observed that the non-combustible nature of the very walls and fire-proof floors, would cause the story to assume the character of a retort, and would also cause the combustion of the materials to take place under such conditions, as to develop a degree of heat capable of melting the very building materials, and to give rise to spontaneous combustion in the goods contained in the other rooms than the one where the fire originated. It also seems to be necessary to limit to some extent the quantities of goods of particular kinds to be stored in the same warehouses; and the peculiar phenomenon of spontaneous combustion evidently requires to be more carefully studied than it has hitherto been.

Some ill-natured remarks have been made with respect to the asserted deficiency of water at the commencement of this fire; but the Southwark and Vauxhall Company have very triumphantly refuted the accusations so made. Be this as it may, a grave question seems to us to be involved in this matter, viz.—why should the Water and the Insurance Companies be obliged to assume the burthen of the part of the municipal function connected with the extinction of fires? In most countries the fire brigades and the water supply for these purposes are paid for by the towns; in England the water companies are obliged to supply the water for the extinction of fires gratuitously, and the insurance offices pay for the fire brigades out of the funds contributed by their customers. It is thus possible that a person who contributes nothing to either of those companies, may derive the benefit of their organization; and in justice to the companies, it really seems that a system should be introduced by which, if a fire occurred upon premises not insured, or not paying water-rates, the proprietor should be made to pay for the service rendered to him. This is a more serious question than might at first be thought to be the case; for the quantity of water supplied by the companies gratuitously for municipal purposes, is not less than 10 per cent. of the total quantity usually supplied; what the cost of the fire brigade may be we do not happen to know; it must be very great, however. Surely they who benefit by these services ought to contribute proportionally towards them.

A patent has lately been taken out, under the name of Aston's Patent Disc Propeller, to which the attention of parties connected with canal property may advantageously be directed. That gentleman proposes to obtain motive power by the revolution of a series of light discs, keyed upon an axis perpendicular to the line of keel; and he asserts that the friction upon the faces of the discs is sufficient to create the power, whilst it is thus obtained without the formation of any wave. We confess, for our own parts, that we are sceptical as to the results said to have been obtained by these disc engines; and, at any rate, we would call attention to the fact that the wave of displacement, caused by the movement of the floating body, is more injurious in a canal than the waves produced by the action of the paddle wheels, or screw, usually employed. The property embarked in the canals and canalized rivers of England is, however, so enormous, that every invention which is likely to rescue it from the state of neglect in which it now is, must be of interest to all who are connected with practical mechanics; at the present day, moreover, when it has become so important to obtain the greatest possible advantages from the East Indian irrigation canals, by making them serve partially as means of intercommunication, the economical application of steam power upon them becomes of almost national importance.

Some considerable activity seems now to prevail amongst the parties connected with mining operations, and especially in matters relating to the extraction of coal. Thus Mr R. H. Hughes, of Hatton Garden, has recently taken out a patent "for supplying fresh air to mines and other places, by forcing it thereto, and to the various parts thereof, by suitable pipes or channels, under pressure." To what extent such a patent may be valid we are not at present able to say; because, unless Mr Hughes should have introduced some new machinery for the purpose, there seems to be little reason for believing that the forcing of air into mines under pressure can be made the subject of a privilege. The philosophical question involved in this case, viz., whether air should be forced into a mine for the purpose of ventilation, or drawn out when impure, is however a very important one, and it is now being warmly discussed by mining engineers. It certainly would appear to possess this advantage, amongst others, viz., that the compressed air would tend to check the escape of fire-damp; whilst the exhaustion of the air, in the manner usually effected, tends to relieve the pressure upon the gases contained in the workings. Air, distributed through pipes under pressure, would also be more under control than the air introduced through common down-cast shafts; and in well-sinking, Mr Hughes's system seems to be likely to render great service. The descriptions already published, as to the methods of founding the Rochester, Kiel, and Theiss Bridges, would no doubt furnish many valuable hints for the improvement of the processes hitherto employed in our mining districts for the creation of an artificial ventilation of this description.

Another rather important patent has lately been taken out by Mr J. A. Phillips, for obtaining white lead direct from the ore, which will, no doubt, rejoice the hearts of the house painters who have suffered so much from the adulteration of the white lead of commerce. Mr Crockford, of Holywell, has also introduced a new method of converting to a useful purpose the sulphur contained in the sulphurets of zinc, which, in its turn, may render service to the building arts. Moreover, we observe that the Danish merchants are exporting, in rather large quantities, the chrysolite of Iceland, for the preparation of aluminium; and that serious efforts are being made to develop the mineral resources of that inhospitable, but naturally wealthy island. It is very strange, we would here observe, that whilst Iceland is being thus made a field for speculation, the Mediterranean islands should be treated with such neglect; Corsica and Sardinia, in particular, we personally know would be as worthy of exploration as ever Iceland can be. They are in the very highway of civilization, and in temperate climates, yet they are as little known as the islands of the Arctic circle. Our notice of the patents and new inventions connected with metallic works must at present be closed by mentioning that, in one of the late meetings of the Society of Mechanical Engineers, a paper was read by Mr S. Lloyd, of Wednesbury, on this subject; and in the course of the discussion which ensued, some very interesting observations were made with respect to the practical results hitherto obtained by the iron founders of the Midland counties in their endeavours to secure the desired economy. It is precisely in this direction that the efforts of inventors should now be turned, in metallurgical operations at least; and it is on this account that we allude to it, and at the same time recommend our readers to study the paper by Mr Lloyd, as well as some very important articles contained in the Mining Journal, and the Annales des Mines. The fierce competition of the foreign iron producing districts with those of our own country renders it more than ever essential for our manufacturers to diminish the cost of production of the raw material.

Messrs de Ruolz and de Fontenay have lately introduced a new alloy of silver, nickel, and copper, which will, if all reports be true, prove of great service in the arts. Is there any probability of our being able to discover in some alloy of nickel and iron a remedy for the fouling of iron ships? This is an industrial problem which may well be commended to the attention of inventors, for the economical results of the "fleet of the future" will depend greatly on its solution.

At Manchester, we hear that a new kind of tram-road, upon the system of Mr Heywood, of Eccles, is in course of trial; and from the description of it hitherto given, it seems likely to obviate many of the practical inconveniences attached to the Train's street railways. Mr Heywood's system consists in the use of two perfectly flat plates, on which the wheels run, and of a central plate bearing a groove to receive a fifth wheel or guide, arranged to move vertically at will. In this manner the railway carriages can easily be taken off the trams whenever that may be required to be done, and as easily fastened upon them again, whilst the absence of the flanges on the trams prevents the latter from interfering with the ordinary traffic in the same manner that Mr Train's street railways unquestionably do.

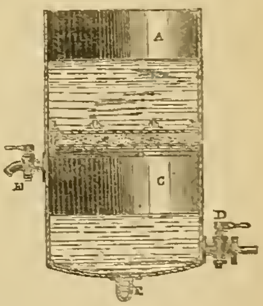
The disturbance in the cotton and other markets produced by the civil war in America, seems to be producing some startling effects of rather an unexpected nature. In the first place, new materials able to supersede entirely the use of cotton are stated to have been discovered; in the second, no less than fifty-eight new sources of supply of cotton itself have been opened up. This is as it should be, and our manufacturers have now a fair prospect of escaping from their dependence upon the slave states of America, as well as of securing a cheaper market for their raw material. In other branches of manufacture the same cause appears to be producing the same effect; and the exclusion of the beautiful pine-wood of Florida and South Carolina, from the shipbuilding yards of Europe and of North America, is leading either to the substitution of iron for wood, or to the substitution of the white oak, the Vancouver's Island, or the New Zealand timbers, for the pitch pines. Out of evil thus good comes; and men learn, when necessity drives, to find remedies for those evils which at first seemed irreparable; but what a fearful disturbance of all social and commercial relations is implied in every such revolution of trade as is thus alluded to! What a lesson does it read to those who are able to look beneath the surface, to the effect that every social condition which depends for its existence on a great moral wrong, such as the slave trade—must eventually be the cause of suffering even to those who tolerate that wrong! It may appear rather a far fetched train of reasoning thus to connect the interests of practical mechanics with moral questions of this description; but the recent course of events has shown that the interests of mankind are so interwoven that whatever affects one section of our race, must react upon all the rest.

These remarks must be closed by a tribute to the memory of one who has rendered good service to the cause of practical mechanics, and has contributed greatly to modify the external character of the constructive arts. Mr Eaton Hodgkinson has passed from amongst us, leaving behind him the reputation of an earnest lover of truth, of a good man, and of a useful citizen. His researches in the difficult subject of the strength of materials, and the practical results drawn from them in the construction of the Britannia and Conway Bridges, and in the modern applications of cast iron, have deservedly ranked Mr Hodgkinson's name amongst the brightest ornaments of our scientific world. Perhaps the cultivation of abstract science is treated with neglect in England at the present day; and the loss of such men as Mr Hodgkinson is to be the more regretted on that account. At any rate it is to him we owe the existing form of scientific knowledge in things connected with the resistance of cast and wrought iron, and of the theoretical principles affecting their elasticity; and well, indeed, had he earned the gratitude of society for the application he had made of his singularly useful faculties.

FILTERING LIQUIDS.

Messrs Purel, Morin, & Co., of Paris, have invented a new system of filtering liquids, which is based upon the physical effect produced by atmospheric pressure, resulting from the formation of a vacuum produced by the condensation of vapours, which are introduced into the apparatus beneath the liquid to be filtered, such liquids being open to the free atmosphere. The apparatus introduced for carrying out this system is especially applicable to the washing of all kinds of substances from which the soluble parts are to be extracted, whether by the aid of water or other vehicle, by causing the water to be immediately succeeded by the filtration of the liquid. This apparatus may also be used as a simple filter for any kind of liquid, fatty bodies, alcohol, &c., and generally in all cases where it is required to separate and remove the solid matter mixed with, or held in suspension in a liquid It may also be employed, to a certain extent, as a hydro-extractor, for the partial drying of various substances.

The woodcut annexed represents a vertical section of this filter. It consists of a strong cylindrical metal vessel, A, the surface of the metal being suitably coated or protected so as to prevent oxidation. In some cases, this vessel may be lined with wood. the advantage of which is, that as it is a bad conductor of heat, it will have a less tendency to produce condensation of the steam or vapour than a metallic surface. At about its vertical centre, this vessel is provided with an annular flange, projecting inwards, for supporting a perforated metal or wooden diaphragm, B, over which is placed a sheet of wire-gauze. Upon this gauze is laid the filtering medium, consisting of woven fabric, felt, tow, carded wadding, sponge, sand, powdered pumice, or other substance suitable for the purpose. On the top of the filtering medium is placed a second sheet of wire gauze, and the whole is kept in position by a metal ring, held down by key bolts passing through the several dices—suitable packing, of caoutchouc, or other substance, being employed, so as to prevent all escape of the liquid, excepting through the filtering medium. In the lower portion, C, of the apparatus, there are fitted three stop-cocks, D, E, and F. The cock, D, placed at the lower part of the vessel is connected, by means of a steam pipe, with a boiler, or steam generator. The cock, E, placed immediately below the filtering medium, serves to admit air into the lower portion of the apparatus when required, and the cock, F, in the bottom of the apparatus, enables the same to be emptied. When the apparatus is to be used, the upper part, which is open to the atmosphere, is filled with the liquid to be filtered. The cocks, D and E, are then opened, so as to fill the lower part of the apparatus with steam, and expel the air therefrom. On the steam issuing freely from the cock, E, it is to be closed, after which the cock, D, is also closed. In a few minutes the steam in the apparatus will be condensed, and a vacuum consequently formed in the chamber,



C, when the atmospheric pressure, acting upon the liquid in the upper part, A, of the filter, forces it through the filtering medium, upon which the solid matters are deposited in regular layers. After this operation, if it be desired to wash the deposited solid matters, the vessel is to be refilled with liquid, and the process of filtration, as above described, repeated. In order to effect a still more complete washing of these solid substances, they should be well agitated in their containing liquid before the vacuum is formed, and if the washing is to be effected by means of a heated liquid, steam may be diffused therein, through a perforated serpentine, or rose jet. The vapour of water, or ordinary steam, will be usually employed in this system of filtration. Nevertheless, other kinds of vapours may be occasionally used with advantage, as, for example, in the treatment of schists, which will not combine and mix with foreign bodies, if ordinary steam were used, and the water of condensation collecting at the bottom of the chamber, C, would materially interfere with the purifying process. In the case in question, it would be requisite to employ vapours produced from the same substance as that under treatment. In lieu of the apparatus being composed of a cylindrical vessel divided into two parts, one above the other, it may obviously be composed of two distinct vessels connected by a pipe provided with a stop-cock, which should remain closed during the entrance of the steam or vapour. By this arrangement, the loss of a certain portion of the steam arising from its condensation on coming in contact with the cold and moist filtering surface, is obviated. In this case, the filtering medium should be placed very near to the bottom of the first vessel, but not actually in contact therewith. Or the two vessels may be placed side by side, on the same horizontal plane, in place of being one above the other. In this arrangement, the pipe which unites them communicates from one bottom to the other. This arrangement, which involves a slight loss of atmospheric pressure, is, nevertheless, more convenient to work, by diminishing the height of the apparatus. If preferred, an air-pump may be substituted for the mode above described of producing a vacuum, but the first mode has the advantage of simplicity, as it dispenses with the necessity of expensive mechanical appliances. The second method may, however, in some cases be found preferable, as, for example, where it is required to operate upon substances with which the admixture of the water of condensation might, as we have indicated above, be found injurious or prejudicial.

BOAT BUILDING BY MACHINERY.

BUILDING boats by machinery, and with economy sufficient to supersede ordinary hand labour, does not seem a thing very easy to accomplish; but we really believe that Mr Nathan Thomson has succeeded in devising plans which have this result. We say this after having given the machinery now at work a careful examination. The establishment is but a temporary one, and the present operations only experimental, the whole affair, as may be seen from another part of our journal, being shortly to pass into the hands of a public company; but it appears to us plain enough that this is another of those telling blows that skilled labour is continually receiving from the engineer.

In calculating the result arising from the introduction of machinery, we must always bear in mind that it is the item forming the cost of labour which is alone capable of reduction. The cost of the material must, in most instances, remain the same. Hence, the employment of machinery will, as a general rule, be successful in a commercial point of view, in proportion to the largeness of the item of labour in the total result, under the old system of operation. Yet even where that item has been comparatively small, the engineer has been able to enter and displace manual labour; for example, in cask making, where machinery has been profitably employed, although the labour formed only about one-sixth of the total cost. Still greater has been the profit of working by machinery where the cost of the material has borne a less proportion to the entire cost than this; as for instance in the making of carriage wheels, where the material was only about twice as expensive as the labour.

We do not say that Mr Thomson has reached absolute perfection in his machinery. Probably a critical eye might detect weak points in it here and there; and, no doubt, improvements in details will be suggested as more experience is gained of its actual working. But it is an undeniable fact that he has succeeded in building boats by means of very ingenious mechanical devices, and that these boats are produced at a lower cost, and with much geater expedition than was possible under the old system.

We shall now proceed to give a short description of the new method of making boats, as witnessed by us on a recent visit to the works in London.

The assembling, or setting-up form, which is the leading feature of the invention, may be described as an open frame-work, in outline the exact size and shape that may be necessary to give a bearing to the keel, stem, stern, floor-timbers, and ribs, which are necessary to form the boat; the positions of the various pieces are defined in some cases by suitable recesses, and in others by projections so arranged that the timbers when placed assume their exact position. The next process is to transfer these points from the form to the necessary auxiliary forms and templates that are required to assist the machinery in its various stages. A complete set of templates are made, which answer to the external curvature or bearing points of the form, and these templates are then marked with the reference figures, taken from the form. The compound templates are so constructed that they not only serve to guide the timber through the machine, but where irregularly shaped grooves are required, such as that to receive the planking in the stern, they cause the cutters to assume different positions. A series of moulds, representing the various sections of the interior of the boat, are constructed, and on these the ribs, floor-timbers, and other portions are bent. The first machine consists of a circular saw, having an adjustable fence, which can be inclined from the saw, and thus admit of timber being cut thicker on one edge than the other; the clamps for fixing the timber can be projected from the face of the fence, so that a taper may be given to the timber in the direction of its length. The pieces intended for the ribs, &c., that have to be bent, are strained, and they are backed with an iron plate, and bent over the moulds in the usual manner; but this operation is expedited by the application of power to assist in bending the material. It is either left to dry or is passed forward into stoves to facilitate the drying. The bent timber is next cut on the square to the proper thickness at an ordinary circular saw, the fence of which is made exceedingly large to assist in guiding it, and an inclined fence is placed at the back of the saw to secure the end of the timber, so that its position remains unchanged during the process. The timbers are now passed through the planing machine, and both sides are rendered smooth. The shaping machinery consists of three machines, one having a pair of fixed vertical spindles, having a concentric guide above the table, and a pair of cutter heads, running in opposite directions, projecting above the same, and two other single machines, each having an inclined spindle, overhanging a D guide, each spindle running in an opposite direction. (Kinder's machine, described in the *P. M. J.*, vol. iii., 2nd series, p. 113, will perform all the operations of these three machines) The templates are now brought into use. For square work it is merely necessary to affix the template to the timber and use the double spindle shaping machine, and an exact fac-simile is produced. In bevelled work, the inclined spindles are alone required. The planed rib, or other timber, is fixed in its respective template, which marks the curve of the bottom edge, an auxiliary template is laid on the same, and, fitting on the register points, serves to mark the curvature of the top edge. Now, as the spindle is inclined in excess of the greatest bevel, and if the timber is made to traverse in the same plane as the inclination, a square cut will be obtained, it follows that, by changing the position of the cutting edge, by rotating the timber on the surface of the table, that the operator may trace the upper curvature by cutting the pencilled line. The timber being finished on this edge is changed to the other side of the same template, and if the edge last worked does not fit the bed prepared to receive it, the error is apparent, and this stage cannot be proceeded with until corrected. The upper curvature is again marked, and the same process followed. The finished timbers are then marked with the reference figures, and are ready for the subsequent operations or for assembling. This system of templates, checking as they do each successive stage, prevents any serious loss from inattention or error, in fact the material is quite as economically converted as it would be by the old process. The keel and stern having been worked on the square to the template, the latter fits into the compound template, and it is passed through the rebating machine. In this machine the cutters operate above and below the material, and each of these cutters is mounted in frames which swing in trunnions, the inclines attached to the compound templates so change the position of the cutters during the passage of the timber through the machine that a winding or constantly changing groove is produced to receive the planking. This machine is mounted on a circular railway, and, if necessary, may be turned about to suit the timber when this is too heavy to be easily managed by hand.

The next machine is Mr Thomson's masterpiece, and is certainly the most ingenious and perfect arrangement that can be conceived for the purpose of accomplishing the end he had in view. The planking of a boat, is not absolutely flat in any one part, but has its surface curvature constantly changing, and this machine is designed to effect this result. The planks are worked to an even thickness, and are concave on one side and convex upon the other. The template for the plank is laid upon a piece of timber, the curve on the edge is marked off, the reference figures on the template denoting the degree of local curvature are transferred to the timber, the edges are roughly dressed with the circular saw, and it is ready for this machine. The spindles are placed one over the other, and have a pair of centres on each of considerable length. The upper centre works a slightly concave, and the longer one a convex surface. This centre frame rotates in a horizontal direction, and can be placed obliquely, so that the whole curvature of the cutting edge is thrown on to the surface of the plank. When the centre spindles stand at right angles to the plank, in the direction of its length, only a portion of their curvature is imparted to its surface; but as the plank passes through the machine, the reference figures denote to the attendant the necessary obliquity of the centre spindles, and the various changes in the local curvature are effected. The subsequent processes for working the edges, bevelling, moulding, &c., are more simple, and need no remarks. Suffice it to say, that every piece of timber is prepared entirely by machinery, and that the workmen have simply to place them in their respective positions on the assembling form, and secure them in the usual manner. The labour, however, is capable of being most minutely subdivided, so that the various processes can be carried on stage by stage on the respective forms, by different sets of hands, without their in any way interfering with each other.

In conclusion, we may congratulate Mr Thomson in having brought his system to such a state of completeness. We fully believe that the promised economy may be easily effected; but of course all depends on the skill and prudence with which the business is conducted.

THE COLOURING MATTERS DERIVED FROM COAL-TAR.*

The coal-tar products which have, up to the present, yielded colouring matters are numerous. The following is a list of the most important, which are obtained either directly or indirectly from coal-tar, namely—aniline and its homologues, carbolic acid, chinoline or quinoline, naphthaline, and pyrole bases.

Aniline was discovered in 1826. The original method for its preparation was by digesting indigo with hydrate of potassium, and subjecting the resulting product to distillation. Aniline was also obtained from the basic oils of coal-tar; but the process which is now employed for its preparation is a remarkable instance of the manner in which abstract scientific research becomes, in the course of time, of the most important practical service. It was Faraday who first discovered benzole; he found it in oil-gas. After this it was obtained by distilling benzoic acid with baryta, which result determined its formula, and was the cause of it being called benzole. After this, Mansfield found it to exist in large quantities in common coal-tar naptha, which is the source from which it is now obtained in very large quantities. Benzole, when studied in the laboratory, was found to yield, under the influence of nitric acid, nitro-benzole. Zinin afterwards discovered the remarkable reaction which sulphide of ammonium exerts upon nitro-benzole, converting it into aniline. And, lastly, Bechamp found that nitro-benzole was converted into aniline when submitted to the action of ferrous acetate. It is Bechamp's process which is now employed for the preparation of aniline by the ton. Had it not been for the investigations briefly cited above, the beautiful aniline colours now so extensively employed, would still remain unknown. When I discovered aniline purple, nitro-benzole and aniline were only to be met with in the laboratory; in fact, half a pound of aniline was then esteemed quite a treasure, and it was not until a great deal of time and money had been expended that I succeeded in obtaining this substance in large quantities, and at a price sufficiently low for commercial purposes.

The colouring matters obtainable from aniline are numerous. They are the following:—Aniline purple, violine, roseine, fuchsine, alpha aniline purple, bleu de Paris, nitroso-phenyline, dinitraniline, and nitrophenyline diamine.

Aniline Purple, generally known as Tyrian Purple, Mauve, Phenamine, Indisine, &c.—It has been known for many years that the hypochlorites react on aniline and its salts, producing a purple-coloured solution; in fact, hypochlorites are the distinguishing test for aniline; but nothing definite was known of this purple-coloured solution, it being simply stated that aniline produced with hypochlorites a purple-coloured liquid, but that this colour was very fugitive.

The method adopted for the preparation of aniline purple is as follows:—Solutions of equivalent proportions of sulphate of aniline and bichromate of potassium are mixed, and allowed to stand till the reaction is complete. The resulting black precipitate is then thrown on a filter and washed with water until free from sulphate of potassium. It is then dried. This dry product is afterwards digested several times with coal-tar naphtha until all resinous matter is separated, and the naphtha ceases to be coloured brown. After this, it is repeatedly boiled with alcohol to extract the colouring matter. This alcoholic solution when distilled, leaves the colouring matter in the bottom of the retort as a beautiful bronze-coloured substance.

The aniline purple prepared according to the process just described, although suitable for practical purposes, is not chemically pure. If required pure it is best to boil it in a large quantity of water, then filter the resulting coloured solution, and precipitate the colouring matter from it by means of an alkali. The precipitate thus obtained should be collected on a filter, washed with water until free from alkali, and dried. When dry it is to be dissolved in absolute alcohol, the resulting solution filtered, and then evaporated to dryness over the water-bath. Thus obtained, aniline purple appears as a brittle substance, having a beautiful bronze-coloured surface, but if some of its alcoholic solution be evaporated on a glass plate, and viewed by transmitted light, it appears a beautiful bluish violet colour. If considerable quantities of an alcoholic solution of the colouring matter, containing a little water, be evaporated to dryness, the surface of the colouring matter next to the evaporating dish when detached, often possesses a golden green appearance. Aniline purple is difficultly soluble in cold water, although it imparts a deep purple colour to that liquid. It is more soluble in hot water, but its hot aqueous solution when left to cool assumes the form of a purple jelly. It is very soluble in alcohols, though nearly insoluble in ether and hydrocarbons. Aniline dissolves it readily. In properties it seems to be slightly basic, as it is more soluble in acidulated than in pure water. Alkalies and saline substances precipitate it from its aqueous solution as a dark purplish-black powder. Bichloride of mercury precipitates it in a very finely divided state. A little of this precipitate, which appears to be a double compound of chloride of mercury and colouring matter, when suspended in water and viewed by transmitted light, appears of a blue or violet colour. If a small quantity of hydrate of potassium or sodium be added to an alcoholic solution of the colouring matter, it causes it to assume a violet tint, but without effecting any change in the colouring matter itself. Ebulition with alcoholic potash does not decompose it. Aniline purple dissolves in concentrated sulphuric acid, forming a dirty green solution. This when slightly diluted assumes a beautiful blue colour. Excess of water restores it to its original purple colour. I have had a specimen of this colouring matter heated for an hour to 100 centrigrade with Nordhausen sulphuric acid without suffering decomposition, being restored to its original colour by means of water, and possessing precisely the same properties as it had before being subjected to this powerful agent. Hydrochloric acid acts upon it in the same manner as sulphuric acid. It is decomposed by chlorine, and also by fuming nitric acid. Bichloride of tin is without action upon it. Powerful reducing agents have a peculiar action upon this colouring matter, somewhat analogous to the action of reducing agents on indigo. An alcoholic solution of sulphide of ammonium, when mixed with an alcoholic solution of the colouring matter, causes it to assume a pale slightly brownish colour. This solution when brought in contact with the atmosphere instantly assumes its beauty and intensity of colour. An alcoholic solution of the colouring matter when mixed with a little protoxide of iron changes to a pale brown colour. This solution also becomes purple when exposed to the action of the atmosphere. Sulphurous acid does not affect the colour of this substance.

This colouring matter forms a remarkable compound with tannin. When an aqueous solution of the colouring matter is mixed with a solution of tannin, precipitation takes place. The precipitate thus formed, after having been well washed, no longer possesses the properties of the pure colouring matter. It is insoluble in water. Like the pure colouring matter it dissolves in concentrated sulphuric acid, forming a dirty green liquid; but on adding an excess of water to this solution the new compound is precipitated unchanged. This compound is rather duller in colour than the pure colouring matter itself. Aniline purple when agitated with a little moist binoxide of lead is transformed into roseine. This colouring matter is remarkable for its intensity, a few grains of it colouring a considerable quantity of spirits of wine.

Violine.—This colouring matter, which is a product of the oxidation of aniline, was first obtained by Dr David Price. He prepares it by heating an aqueous liquid containing two equivalents of sulphuric acid, and one equivalent of aniline to the boiling point, and then adding one equivalent of binoxide of lead, boiling the mixture for some time, and filtering it whilst hot. The filtrate, which is of a dark purple hue, is boiled with potash, both to separate the excess of aniline, and also to precipitate the colouring matter. When all the free aniline is volatilised, the residue is thrown on a filter, and slightly washed with water, and then dissolved in a dilute solution of tartaric acid. This solution after filtration is evaporated to a small bulk, re-filtered, and then precipitated by means of an alkali. Thus obtained, violine presents itself as a blackish purple powder, which when dissolved in alcohol, and evaporated to dryness, appears as a brittle, bronze-coloured substance, similar to aniline purple, but possessing a more coppery-coloured reflection. It is more insoluble in water than the preceding colouring matter; it is very soluble in alcohol, but insoluble in ether and hydrocarbons. These solutions possess a colour somewhat similar to that of the field violet. Concentrated sulphuric acid dissolves it, forming a green solution, but excess of water restores it to its original colour. Like aniline purple, reducing agents deprive it of its colour, but which is restored by the action of the atmosphere. Tannin produces an insoluble compound with it, when agitated with a small quantity of binoxide of lead, it is converted into aniline purple: excess of this re-agent changes it into roseine.

Roseine.—This substance nearly always accompanies aniline purple, though in very small quantities. It was first noticed publicly by C.

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* The substance of a paper read by Mr Perkin, before the Chemical Society.

Greville Williams, and afterwards by Dr David Price. Williams used manganates for its preparation, but Dr David Price prepared it by means of binoxide of lead. His process is as follows:—To a boiling solution of one equivalent of sulphate of aniline, two equivalents of binoxide of lead are added, and the mixture boiled for a short time. The rose-coloured solution is then filtered, and the filtrate evaporated to a small bulk, which causes a certain amount of resinous matter to be separated. This evaporated solution is then filtered, and the colouring matter precipitated by means of an alkali, it is then collected on a filter, slightly washed, and then dried. The colouring matter thus prepared, readily dissolves in alcohol, forming a fine crimson-coloured liquid, which when evaporated to dryness, leaves the colouring matter as a dark, brittle substance, having a slightly metallic reflection. It is much more soluble in water than either aniline purple or violine, but like them, it is insoluble in hydrocarbons, and is more soluble in acids than in neutral liquids. Concentrated sulphuric acid dissolves it, forming a green solution; excess of water restores it to its original colour. It forms a compound with tannin, and is also deodorised, or nearly so, by powerful reducing agents.

The three colouring matters just mentioned, namely, aniline purple, violine, and roseine, are evidently closely allied, for they have nearly the same properties. They are all formed under similar circumstances, namely, by the action of oxidising agents in the presence of water; they are all slightly soluble in water, though as the shade of colour becomes redder, so their solubility increases; alkalies precipitate them from their aqueous solutions; concentrated sulphuric acid dissolves them, forming green solutions which excess of water restores to the original colour of the colouring matters; powerful reducing agents deprive them of their colour or nearly so; but it is again restored by the influence of oxygen; and, lastly, tannin forms insoluble compounds with them all.

Fuchsine or Magenta.—This beautiful product, which is often improperly called roseine, is a member of an entirely different series of compounds from the foregoing, being formed under very different circumstances, and possessing very different properties. This colouring matter was first observed by Natanson, in 1856, when studying the action of chloride of ethylene on aniline, and afterwards, shortly before it was practically introduced into the arts, by Dr Hofmann, when preparing cyantriphenyle diamine by the action of bichloride of carbon on aniline. It was M. Verguin who first brought it forward as a dyeing agent, and who, I believe taught manufacturers how to prepare it on the large scale. Fuchsine is invariably formed at a temperature ranging from 170 to 190 centigrade. It is produced from aniline, by the action of reducible chlorinized, brominized, iodized, or fluorized substances, as well as by weak oxidizing agents. The substances used for its preparation on the large scale are perchlorides of tin and of mercury, and the nitrates of mercury. It has also been prepared with bichloride of carbon.

Preparation of Fuchsine by the Action of Bichloride of Tin on Aniline.—Aniline combines with bichloride of tin, evidently producing a double compound. This product is a white substance, and may be prepared by adding to aniline, bichloride of tin in the anhydrous states or dissolved in water. Anhydrous bichloride of tin combines with aniline with great energy to form this compound. To prepare fuschine from this double compound, it is necessary that it should be free from water, or nearly so; therefore anhydrous bichloride of tin is generally employed for its preparation. The process adopted is as follows:—Anhydrous bichloride of tin is slowly added to an excess of aniline, the mixture being constantly stirred, and the pasty mass thus formed gradually heated. As the temperature increases it becomes quite liquid and also brown in colour. As soon as the temperature nearly approaches the boiling point of the mixture it rapidly changes to a black-looking liquid which when viewed in thin layers, presents a rich crimson colour. This is kept at its boiling point some time, and then well boiled with a large quantity of water. By this means the principal part of the colouring matter is extracted together with considerable quantities of hydrochloride of aniline. The residue is a solid of brown colour, and contains considerable quantities of tin in the form of a proto-compound. The aqueous solution of the colouring matter and hydrochlorate of aniline is then boiled, so as to volatilize any free aniline it may contain, and then saturated with chloride of sodium. The chloride of sodium causes the colouring matter to separate as a semi-solid, pitchy substance of a golden-green aspect, while the hydrochlorate of aniline remains in solution. The colouring matter thus obtained may be further purified by digestion with benzole which dissolves out a certain amount of resinous matter.

Preparation of Fuchsine by the Action of Nitrate of Mercury on Aniline.—When protonitrate of mercury is left in contact with aniline for some time, it forms a white pasty mass; but when carefully heated to 170° or 180° centigrade it reacts upon it, forming a brown liquid, which gradually changes till of a dark crimson colour. At the same time, the whole of the metal of the mercury salt collects at the bottom of the vessel the experiment is conducted in. This product, when separated from the metallic mercury and allowed to cool, becomes semi-solid, being filled with crystals of nitrate of aniline. To purify this product it is best to dissolve out the nitrate of aniline it contains in a small quantity of cold water, and then to boil the remaining product several times with fresh quantities of water until the principal of the colouring matter is extracted, and filter the resulting aqueous solutions while hot. On cooling the solutions will deposit the colouring matter as a golden-green tarry substance, from which benzole separates a small quantity of a brown impurity, leaving the colouring matter as a brittle solid.

I have briefly described the above processes because they may to some extent be regarded as types of most of the methods employed for the production of this colouring matter, the first representing its formation by the action of reducible chlorides upon aniline, and the latter by the influence of weak oxidising agents.

Fuchsine is undoubtedly an organic base, and a more powerful one than is generally supposed. The product obtained from aniline by means of bichloride of tin is hydrochlorate of fuchsine, and that obtained by the oxidising action of nitrate of mercury is the nitrate of fuchsine. My reason for stating this is, that on examining the colouring matter obtained by chloride of tin I found it to contain large quantities of combined hydrochloric acid, and when nitrate of mercury was used considerable quantities of combined nitric acid; therefore I conclude that the former is the hydrochlorate and the latter the nitrate.

Fuchsine is separated from its salts by precipitation with a small quantity of ammonia. When freshly precipitated, fuchsine is a red bulky paste which, when dry, contracts, forming a purplish red powder. It is difficultly soluble in water, though tolerably soluble in alcohol; it is not soluble in ether or hydrocarbons; a small quantity of hydrochloric acid causes it to dissolve freely in hot water, but an excess of either hydrochloric acid or sulphuric acid dissolves it, forming a brownish yellow liquid, from which ammonia separates it unchanged. By this reaction it may be distinguished from roseine, which dissolves in strong sulphuric acid, producing a green liquid. Caustic alkalies, or ammonia in excess, partially precipitate fuchsine from its salts; but, at the same time, dissolve a considerable quantity of it, forming nearly colourless liquids. Acetic acid added to these alkaline solutions restores the colour of the fuchsine; and if the liquids are concentrated, the base precipitates as a red, flocculent substance. An alcoholic solution of fuchsine when evaporated to dryness, leaves the colouring matter as a brittle mass, having a remarkably beautiful golden-green metallic reflection. By transmitted light it has a red colour. M. Bechamp has analysed carefully-prepared specimens of fuchsine, and found it to have the formula $C_{12} H_{12} N_2 O$.

Bleu de Paris.—This is yet another colouring matter, produced under circumstances similar to those which give rise to fuchsine. MM. Persoz, V. de Luynes, and Salvetat give the following account of its preparation and properties—"9 grammes of bichloride of tin and 16 grammes of aniline, heated for 30 hours to a temperature of about 180 centigrade, in a sealed tube, produce neither a red nor a violet, but a very pure and lively blue This blue, which resists acids, darkens in colour by alkalies, but passes to a groselle violet when submitted to this agent in a concentrated state. It preserves its beauty of colour by artificial light, and it dyes animal fibres of a shade whose beauty leaves nothing to be desired." I repeated the above experiment twice, and was inclined to give up in despair, for instead of a fine blue I obtained nothing more than a dirty green product. But from this unpromising product I at last succeeded in obtaining this beautiful blue colouring matter, and found it to possess all the properties mentioned above. MM. Persoz, V. de Luynes, and Salvetat, have lately given a more particular account of this colouring matter. They describe it as crystallising from the alcoholic solution in the form of fine needles, having an aspect similar to that of ammoniacal sulphate of copper. It is soluble in water, alcohol, wood-spirit, and acetic acid; but insoluble in ether and bisulphide of carbon. With concentrated sulphuric acid it forms an amber-coloured solution, which water converts into a magnificent blue liquid. Strong nitric acid decomposes it, chromic acid precipitates it from its aqueous solutions without decomposition; chlorine destroys it; sulphurous acid does not decolorise it. I found that sulphide of ammonium is also without action upon it. It is precipitated from its aqueous solutions by alkalies and saline compounds.

Aniline Green, or Emeraldine.—Most chemists who have worked with aniline in the laboratory must have noticed the peculiar green-coloured-substance which forms on the outside of the various species of chemical apparatus that have been standing in the vicinity of any quantity of this body. This product is aniline green. Aniline green has been known for many years. It may be formed by various processes. One process consists in oxidising aniline with chloric acid. This is effected by mixing a hydrochloric acid solution of aniline with chlorate of potassium. It may also be obtained by oxidising a salt of aniline with perchloride of iron. Obtained by either of these processes it presents itself as a dull green precipitate which, when dried, assumes an olive-green colour. It is insoluble in water, alcohol, ether, and benzole; sulphuric acid dissolves it, forming a dirty purple-coloured solution, from which it is precipitated unchanged by water. With alkaline solutions it changes to a deep colour somewhat similar to indigo; but acids restore it to its original colour. The colour of aniline green is much enlivened by the presence of an excess of acid; but, unfortunately, as soon as this acid is removed, it passes back to its normal colour.

The bases toluidine, xylidine, and cumidine yield colouring matters under the influence of oxidising agents; and also when submitted to the action of reducible chlorides at high temperatures, analogous to those obtained from aniline, under similar circumstances; but the results generally are not so good, the colour of the products becoming tinged with brown as the bases get higher in the series.

AGRICULTURAL MACHINES AT LEEDS.

As chroniclers of the application of machinery to the material benefit of man, it is our duty to give some account of the trials of agricultural machines which have lately been made at Leeds, under the auspices of the Royal Agricultural Society. The great number of persons who attended these trials is an evidence that the question of the application of steam machinery to agriculture is one that has a deep hold on the public mind. Although this application is yet in its infancy, not only as regards its extent, but also as regards the character of the machines themselves, excellent as many of them are, yet the manufacture of such machines is now a considerable branch of trade, and the capital invested in that branch, and in the purchase of machinery by agriculturists, is very large. Although the great advantage of cultivating by steam power, instead of by the old methods, has been practically proved, and is indeed universally acknowledged, farmers and manufacturers are alike far from being satisfied with the present state of things, as is shown by the attempts continually made to remedy defects, and seize upon improvements. A gradual progress, year by year, is thus brought about. Manufacturers tax their invention, and eagerly struggle for ascendancy, knowing that increased efficiency will always be thankfully acknowledged and rewarded by the farmer. On this occasion, the following were the principal machines produced before Mr Amos, C.E., the consulting engineer; and the judges, Mr Owen of Rotheram, Mr Owen Wallis of Overstone, and Mr C. S. Read of Plumstead, Norwich, accompanied by the Hon. Aug. Vernon, acting-steward, and Mr Brandreth Gibbs, honorary director.

Messrs Howard, Britannia Iron Works, Bedford, produced a machine having the rope supported by anti-friction roller porters lying round the four sides of the field, and having an anchored pulley at each corner. Two of the anchors were fixed, the other two were shifted by hand along the headland as required. The grubber was powerful but very light, the tines having backward and forward shares shaped somewhat like the letter Y reversed, so that either end of the implement might work. Sharp-edged wheels, directed by a workman placed on the implement, effected the steering. If a forty-yard length of chain were anchored along the headland, the pulley might be shifted by the strain of the rope itself, and thus the hand-labour of two men would be saved. The two ropes which meet at the implement and at the windlass stationed against the engine are alternately wound upon and unwound from two drums. A man guides the rope with a loose rope, and thus secures its regular coiling. The axletree of a pair of high travelling wheels forms the horizontal axis on which the drums are hung. The pinion-shaft is supported by brackets at each end above the drums, from which they receive motion, and the windlass is held in its position by a pair of horse-shafts resting on the ground. The barrels rotating upon short hollow axes placed eccentrically upon the main axletree, they are slightly lifted or lowered in or out of gear with the pinions above by easily turning round the hollow axis with handles. The weight of the whole, without rope, is about 26 cwt. The driving is effected by means of a spindle with two universal joints of flexible india rubber connecting the pinion-shaft to the engine crank-shaft. This plan has been found a great improvement on the old driving band.

Messrs Howard had also a duplicate apparatus similar to the above, which was worked by a double cylinder 10-horse engine without self-propelling gear for travelling. This was entered in competition for the prize offered for an ordinary portable engine not exceeding 10-horse power.

The same manufacturers had a new implement for common ploughing, consisting of two sets of shares, mould boards and coulters fixed, one set below the other, in an inverted position above a beam-frame, which was supported by end carriages on wheels used for steering. When it was desired to take one set of three ploughs out of work, and to bring the other three sets to the ground for ploughing the return furrows, the frame was turned half round by an axial motion.

Mr John Fowler exhibited an apparatus which worked an endless rope by means of a grooved drum instead of two ropes by coiling on barrels. The rope passes only one half turn round the drum, which is placed under the boiler of the engine, and one half turn round an anchored pulley which slowly travels along the other end of the field of its own accord by motion derived from the rope, and the machine is hauled backwards and forwards between its anchorage and the engine. The groove of the drum being V shaped, can grip the rope sufficiently tightly to pull without stop with all the power of a 12-horse engine, by forming its cheeks of a number of separate segments, acting in pairs, and so hinged on the top and bottom flanges of the drum as to hold the rope in proportion to the inward pressure of the rope itself. A new method of keeping the rope off the ground, and thereby both economising power and preventing wear has been adopted. This consists of two small coiling barrels on the plough, which enable the pulling rope to maintain sufficient tension in the slack rope to hold it off the ground, and to give out or take up rope without trouble to the ploughman, according to the varying lengths of furrow in an irregularly shaped enclosure. Ploughing, scarifying, trenching, digging, ridging, &c., can be effected by the same implement frame balanced upon one pair of large-sized travelling wheels when fitted with suitable shares. A harrow may also be worked from an iron loop projecting at the side.

Mr Fowler had also an entry for the prize offered for a portable engine not exceeding 10-horse power. This consisted of a simple single cylinder 8-horse engine. When placed at one corner of a field with a clip drum on a separate pair of carriage wheels placed beside, this was actuated by bevel gear and a spindle and universal joints from the engine crank shaft. The endless rope was laid out on a triangle, and two of the self-travelling anchorages occupied the corners at the ends of the furrow ploughed. As the work proceeds, and the rope shortens, the surplus is taken up by the barrels upon the implement.

Messrs Richardson and Darlay of Kirton in Lindsay, Lincolnshire, produced a locomotive engine dragging its implement. This engine travelled with ease over the land "like a true steam horse" with a two-furrowed plough behind it. The objection to this class of machine is that the soil when soft and moist is injuriously compressed under the wheels.

Messrs Robey & Co., of Lincoln, shewed an engine which had its hind-wheel axletree lengthened to afford support to two winding drums, one at each side of the boiler, and these were driven from the crank-shaft by intermediate cog-wheels. This arrangement dispensed with a windlass on a separate carriage. The rope was laid round the field, and the implement employed was a three-furrow plough, with two sets in lever frames, partly balancing each other.

Mr Romaine, of Canada West, exhibited a machine manufactured by Messrs Brown & May, of Devizes. This belonged to the class in which the implement is made to propel itself by means of power communicated through a light rope running at a high velocity from an engine, either stationary or moving at intervals, along the headland. This machine has been thus described:—A boiler with two vertical cylinders is mounted in a framing upon two main travelling wheels, fitted with an improved endless railway for bearing the weight on an extended surface upon arable land, and upon two steerage-wheels. At the rear of the machine is a cylinder on a transverse axis, armed with a number of cutting shares or curved spades; this is hung in a lever frame, lowered or raised quickly and easily at pleasure, by means of a steam lifting-cylinder, and the digger is driven with a velocity of about forty revolutions per minute by endless pitch-chains from wheels actuated by pinions on the engine crank-shaft. As the engine travels slowly forward the digger cuts and throws up the soil behind, taking a breadth of more than seven feet, to any reasonable depth; and by commencing a field by going round the outside and finishing in the middle, no turning at the ends is needed.

Messrs Kirby, of Banbury, drove Mr Beard's windlass with an 8-horse engine. The windlass hauled a common horse plough of 2 or 3 furrows which had to be turned round at the end of the field, the rope being shifted by hand from one track to the next.

A windlass on the coiling principle was exhibited by Mr Hayes of Stony Stratford. Its peculiar feature was that the engine never required to be stopped and restarted. Two barrels were mounted in a frame with driving riggers between, for receiving motion from the engine by a band which could be shifted in an instant from one rigger to another, whereby one barrel was released and the other set in motion. A brake was employed to stop the rotation of the free or paying out barrel when it was required to haul, and this brake was operated by a small steam cylinder and piston.

Mr Williams, of Baydon, Wilts, showed a powerful scarifier, whose tines were hung in lever frames adjustable to any depth. Two bows in fronts were used to turn the implement round at the ends of the field. With regard to the trials of the larger machines, we give the following extracts from an able report which appeared in the *Times* newspaper:—In a field of strong loam, lately skimmed two inches deep to kill the weeds, after turnips fed off with sheep, the cultivators were set to work as in preparation for sowing barley. With their five tined grubber and 10-horse engine Messrs Howard broke up the ground six to seven inches deep, at the rate of 11½ acres in 10 hours when in full swing, though, owing to stoppages for alterations, shares broken by the rock, etc., the plot of four acres occupied about five hours. The top was well broken, but, owing to the spaces between the shares, the work had to be crossed, in order to make an even bottom to the full depth. Mr Fowler, with his four-shared plough (having prongs or short breasts on) and his 12-horse engine cultivated seven to eight inches deep, and harrowed at the same time, at the rate of about 14½ acres in 10 hours; but, as this was only when working uninterruptedly, the four acres (owing to alterations, etc.) really occupied about four hours. Much delay was caused by completing the headlands, which this machine can do, but is not adapted for. The hard bottom was perfectly cut, though the top was left more rugged than Messrs Howard's. It was, however, a more tenacious soil and freer from loose stones. Considerable after preparation would be needful before corn could be sown on either of the above plots; but Mr Romaine's digger, churning up the soil, made a tilth at one process, sufficiently fine on the upper surface, and 7 to 8 inches in depth. It is difficult to put a money value on the tillage thus performed; probably it is more effective than a ploughing at 8s, a grubbing at 4s, and harrowing at 2s per acre; that is, 14s per acre altogether; because the subdivision is thorough, being equally minute at bottom as at the top, and the subsoil is left unglazed and unindurated by any sledging plough sole. Indeed, the work is just spade-husbandry performed by steam power; and every one knows that this must be the best tillage obtained by the cheapest of motive powers. On ground foul with rank weeds the subdivision into multiplied scions, instead of upraising for extraction by surface harrowing, may be an objection; but on strong clay, or deep loams, properly cleansed, the advantage of its trenching must be enormous, provided that the weight of some 11 tons should be found not to damage by compression. Owing to a mischance in connection with the engine-pump, a steady operation for many minutes together has not been maintained; but, estimating from the pace and time observed, the rate of work, 7 inches or 8 inches deep, was about seven acres in 10 hours, at a cost of about 5s 6d per acre. In a clover-ley field, where plenty of stone showed itself at 6 inches or 7 inches depth, under a hard and tough staple, covered by a herbage nicely eaten off, experiments showed somewhat close competition between the Howard and Fowler machines, as regards area of ground scarified, and the judges, in carrying out most ably and impartially their difficult task, perhaps unwittingly perplexed the exhibitors by insisting upon the cultivation of headlands of the respective plots. The most important trial, and, indeed, the first actual testing of the coiling against the endless rope systems, in doing precisely the same work, was on a subsequent day. With a double cylinder 10-horse power engine, running at an average of about 60lb. pressure, and a three-furrow plough, Messrs. Howard turned over, at 6 inches depth, 7½ acres in about 14¼ hours—that is, at the rate of 5¼ acres per day of 10 hours. The cost, including 11 cwt. of coal, oil, water, labour of five men and two boys, and 15 per cent. per annum on £545 (charged on 200 days' work in the year), amounted to about 7s 7d per acre; the work by horse labour being valued at 8s to 10s.

With a single cylinder 8-horse power engine, running at an average of about 50lb. pressure, and a four-furrow plough, Mr Fowler turned over, at 6 inches depth, 6½ acres in 7 hours and 38 minutes (including finishing headlands, and loss of time in adjustments of apparatus after commencing); being at the rate of 8½ acres in a day of 10 hours. The expense, including 8 cwt. of coal, oil, water, labour of two men, two lads, and two boys, and 15 per cent. per annum on £528 (charged on 200 days' work in a year), came to about 4s per acre; the work by horse-plough being worth 8s to 10s. Reduced five engines of equal power, the daily area ploughed for each horse-power of the engine engaged is, in Messrs. Howard's case, 1 rood, 7 perches; and, in Mr Fowler's case, 2 roods 34 perches. That is, the same expenditure of power in the same time did, in one case, 242 per cent., or nearly 2½ times more work than the other. This is remarkable, seeing that in this stationary engine arrangement Mr Fowler leads his rope about the field in a triangle, so that he had an average length, of 618 yards of rope out; while Mr Howard had an average length of 737 yards out, or, in other words, one rope was only 16 per cent. shorter than the other. The explanation of this extraordinary mechanical result lies in the carrying of the rope clear off the ground; Mr Amos having shown during the experiments with his dynamometer that a length of 450 yards of rope dragged along the land takes nearly 4¾cwt. draught, whereas, mounted upon friction-roller porters, the draught is only about half a cwt. And at the common pace of steam ploughs each cwt. draught is equivalent to a horse power.

After this result of the trials it will not surprise our readers to learn that Mr Fowler carried off the £50 prize. He obtained, moreover, two other £50 prizes and one £25 prize. Messrs Howard obtained a £25 prize for their windlass, and for a set of ploughs and a cultivator. To Mr Hayes and Messrs Robey were awarded silver medals.

In the class of cultivating implements, Mr Cranston, of King William Street, London, exhibited Wood's American Grass Mower, a light and simple implement, and of easy draught for the horses. Messrs Burgess & Key, of Newgate Street, a firm celebrated for the excellence of their workmanship, exhibited another mower, as did likewise Mr Samuelson, of Banbury. At the trial, the final election lay between the implements of Burgess & Key and Cranston, which were admitted to be exceedingly close. However, the first prize was awarded to the latter, the second to the former. Combined machines, capable of both cutting hay and reaping corn, were produced by Messrs Cranston, Burgess & Key, Samuelson, Cuthbert, and other makers. As the result of the competition, Burgess & Key and Cranston were again before the others, and in very close proximity. Haymakers were exhibited by Messrs Ashley, Howard, Samuelson, Boly, Nicholson, Smith, Underhell, and Kearsley. Some of these were quite new, and others were old ones improved. The implements of Howard and Nicholson were considered ahead of their competitors, and the first prize was awarded to Mr Howard. Horse-rakes were exhibited in great numbers, and there were numerous implements for drilling, distributing manure, and hoeing, but our space forbids us to enter into particulars.

When we state that about 5500 articles were contributed by more than 200 exhibitors, occupying 33 sheds more than a mile and a half in length, with 162 stands for classified implements, and 196 stands for miscellaneous articles; that the number of horses and cattle sent to Leeds was very large, and that an enormous crowd of persons attended the show, our readers will easily understand that this has been the most successful meeting that has ever been held under the auspices of the Royal Agricultural Society.

THE HENRY RIFLE.

During the recent deeply interesting contests at Wimbledon, under the auspices of the National Rifle Association, the performance of the "Henry Rifle" has been spoken of by marksmen in the most flattering manner. The accounts which are given as to its non-liability to foul are remarkable, and it is certainly the favourite weapon with a great number of the most skilful marksmen of the day. We have, in the accompanying figures, shown Mr Henry's most recent improvements in rifling fire arms.

Fig 1 is a transverse section of a rifle barrel, showing several modifications of the patentee's mode of rifling, with a view of obtaining greater accuracy in the flight of the projectile, non-liability to fouling, and reduction of the windage. Fig. 2 is a longitudinal section of a portion of a rifle barrel.

In the first modification shown in fig. 1, the barrel is rifled, so that, in its end view or transverse section, it presents a five-sided figure with angular projections or "lands," extending inwards from the angles of the planes. In other words, the rifling of the barrel forms five plane surfaces, A, and the periphery of the projectile, C, which is indicated by a dotted circle, touches the planes, A, at the centre. In addition to the bearing surfaces thus obtained, there are angular projections, B, which extend inwards from the planes, A, so that the apex of each of the projections, B, is concentric with the centre of the surfaces of its contiguous planes, A. These ridges, B, thus afford a further bearing or support to the projectile, and by this means double the number of points of bearing is obtained. These angular ridges also fill up to a great extent the spaces between the angles of the planes, A, and the periphery of the projectile thus reducing the windage by lessening the amount of expansion necessary to cause the projectile to fit the grooves of the rifle or other fire arm. So that the rotatory or spiral motion of the projectile is obtained with greater certainty, and consequently its flight is rendered more accurate. In another modification the number of plane surfaces, A, is increased to six, affording a corresponding number of bearing points to the projectile, C. The number of the planes, A, in combination with the angular ridges, B, may be increased to twelve planes, or indeed to a greater number, according to the capacity or diameter of the bore of the barrel, the system of rifling being equally applicable to ordnance as to small arms. The system of rifling also combines a series of planes with curvilinear grooves. The planes, A, form a polygonal figure, but at the angle of each plane is a convexly curved groove, B, the ridges or boundary lines of these several grooves thus form the bearing points for the projectile, C.

Fig. 1.

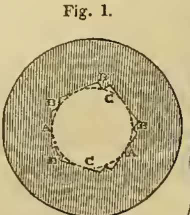
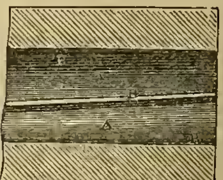


Fig. 2.



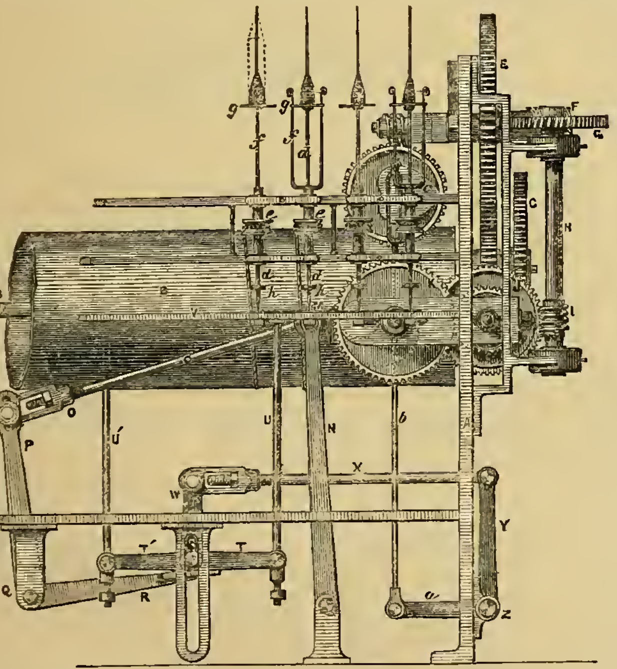
The third kind of "land" forms a rectangular ridge, E, extending longitudinally between the plane surfaces, A, the surface of the ridge affording a very effective bearing point for the projectile. These rectangular, as well as round ridges or "lands," are equally applicable to figures of a greater number of sides than are represented in fig. 1. This system of rifling is particularly adapted for long range shooting, as the grooves admit of a somewhat larger projectile being used than if the plane surfaces were not cut away. So that the amount of expansion necessary to make the projectile fill the groove is lessened, at the same time its figure is so little altered that it traverses through the air with less resistance. With fire-arms rifled according to these modes, a larger charge of powder may be used, as there is less liability of stripping the bullet, thereby giving a lower trajectory, and ensuring greater accuracy in its flight. The beautiful practice which has recently been made with these rifles shows clearly that Mr Henry's views as to the proper construction of rifled fire-arms are correct.

RECENT PATENTS.

SPINNING MACHINERY.

John Watson, *Glasgow, and* C. F. Halle, *Manchester.—Patent dated January* 5, 1861.

The improvements comprehended under these letters embrace arrangements for imparting the necessary reciprocatory movement to the spindles, preventing the ordinary vibratory movement of the flyers, and an improved mode of constructing the spindles.



The accompanying engraving is an elevation of such portions of a spinning frame as are sufficient to show the nature of the invention. The framing, A, of the spinning frame is of the ordinary open panelled kind. At each end of the frame, in the centre of the cross rail of the standards, is arranged the pedestal bearings of the horizontal shaft, B. A pinion on this shaft gives motion to the wheel, C, which is carried on a stud fixed in the end standard. On the stud of the wheel C, is a pinion which gives motion to a spur wheel, and this wheel is in gear with the wheel, E. On the stud of the wheel, E, and outside the end standard, is a worm, F, which gives motion to the worm wheel, G, fast to the vertical shaft, H. The shaft, H, is carried in a bracket-piece that is bolted to the end standard, A, and at the lower part of the shaft is a worm, I, the motion of which actuates the wheel, J. This wheel is carried on an adjustable stud, fixed in a laterally projecting bracket, bolted to the bracket piece of the shaft, H. The stud of the wheel, J, carries a change pinion, which gears with the wheel, K, the stud of which is carried in the same bracket as that of the wheel, J. The boss of the wheel, K, is elongated, and a cam or snail, L, is formed thereon; an antifriction roller, M, presses against the periphery of the cam. The roller, M, runs on a stud fitted in the upper end of the rocking lever, N, which is carried in a short vertical standard fixed to the flooring. To the stud at the upper extremity of the lever, N, is connected the adjustable link, O, the other extremity of which is attached to the lever, P, that is fast to a transverse shaft, Q, carried in brackets pendant from the lower longitudinal rails of the framing. The shaft, Q, is connected by means of duplex levers, R, with a second shaft, S, which rests upon the duplex arms, and is arranged parallel with the first shaft, so as to move up and down in the slotted brackets which form the guides for the shaft, S. Two arms, T and T′, are formed on the shaft, S, near its extremities, projecting in opposite directions. These arms are attached to the vertical rods, U and U′, one of which is fast to the copping rail V, on one side of the machine, and the other is connected in a corresponding manner to the rail on the other side. The shaft, S, has also fast to it a vertical lever, W, which is connected by the link, X, to the lever, Y, this lever is fast to the shaft, Z. The latter shaft is connected by the arm, *a*, with the rod, *b*; the upper end of which is fitted with an antifriction roller, that rests on the periphery of the cam, which forms a part of the heart-wheel, *c*. Upon commencing to fill the series of pirns in the frame, the antifriction roller, M, is resting against the point or extremity of the cam, L, and, as it slowly rotates, its curvature is so arranged that it forms the rounded portion at the lower part of the cop. The rotatory movement of the cam causes the rocking lever, N, to move in a lateral direction towards the end standard, the roller, M, being kept up to the periphery of the cam by means of a counter-weight hung to an arm projecting laterally from the shaft, S. The continued rotatory movement of the cam, L, and the lateral motion of the lever, N, by its connection with the shaft, S, causes the copping rail, V, on each side of the machine to descend gradually, and when the shaft, S, has reached its lowest position, the formation of the cops is completed. Thus, during the filling of the cops, the roller, M, moves over the surface of the cam, L, until it reaches the hollow or inwardly curved portion of the cam, at which point the cops are formed, and the further rotation of the cam is stopped. At the next filling the cam is shifted round a little, either by hand or mechanical means, to bring the roller again in proper contact with the point of the cam. Simultaneously with the regular downward movement of the copping-rails, produced by the cam, L, the cop is built up in the conical form by the heart motion, *c*, in the ordinary manner. The spindles, *d*, are arranged in the usual way in the copping rail, V, as are also the flyers, which are driven by endless bands passing round the wharves, *e*, and the cylinder or drum on the first motion shaft, B. During the uniform descent of the copping-rails, the heart-wheel, *c*, which is driven by a worm on the stud of the wheel, E, is continually causing the spindles to rise and fall through the connection of the rails, V, with the rod, *b*, and the shaft, S. Thus as the heart-wheel continually builds up the cop in a conical figure, caused by its rapid reciprocatory movement, the required diameter of the cop is obtained by the gradual descent of the spindles through the medium of the cam, L. In this way, by altering the curve of the periphery of the cam, L, a corresponding difference will be made in the winding on of the yarn, and the shape of the cop will be altered in proportion. During the rapid rotatory movement of the spindles, *d*, an injurious vibratory movement of the legs of the flyers, *f*, takes place. To avoid this motion, a ring, *g*, is soldered, or otherwise fixed to the upwardly turned legs of the flyer, which effectually prevents the tremulous motion without in any way impairing its efficiency in other respects. Another improvement consists in making the lower extremity of the spindle of larger diameter than the part immediately above it. This arrangement admits of their being fitted much more securely in the footstep bearings by the retaining plates or holders, and prevents their being withdrawn by the removal of the cops. The tension or drag on each spindle is regulated by the string which passes round the wharve, *h*, and has attached to it a weight, the spring being passed through a notch made in the front plate. With this arrangement, the tension on the wharve would be uniform, and in order to make it differential, the copping-rails are caused to move slightly in a lateral direction at each descent caused by the heart motion. This movement is caused by the rail coming in contact with a small inclined plane fitted to the inner face of the end standard, which gives it the required motion, and being independent of the front plates, J, it causes the strings to be drawn a little aside, and the drag is consequently increased on the wharves, *h*, when winding on the smaller diameter of the cop. In this way the yarn is wound uniformly on the pirn, and the cop is formed perfectly regular throughout.

ORNAMENTING EARTHENWARE.

John Venables, *Burslem, Staffordshire.—Patent dated November* 23, 1860.

This invention consists of certain modes of ornamenting the surfaces of earthenware and other articles. For the purpose of ornamenting articles of earthenware, a plate is taken capable of being used in producing the intended ornament; metallic plates being preferred for that purpose. In lieu of engraving plates in the ordinary manner to obtain patterns for ornamenting earthenware, the pattern is cut through the whole thickness of the plate. A pattern plate prepared in this way is laid upon the surface of a bat or other piece of prepared clay in the plastic state. The material to be used in forming the intended ornament should by preference be in a plastic state, such as clay or some other material capable of adhering to the surface of the piece of clay to be ornamented, and of bearing the action of the fire in a pottery kiln. It should also be of such a nature as to contract in the fire to the same extent as the ornamented article.

The material used in forming an ornament may be either coloured or uncoloured, according to the effect intended to be produced; and when the material is to be coloured, it is mixed with a colouring matter which is capable of bearing the action of the fire, or which, when burnt, will produce the intended colour. A portion of the material to be used in forming an ornament is introduced into the cut-through pattern, or into each cut through pattern (if more than one) in the plate, and the material is rubbed or pressed down upon the clay which is to receive the ornament, and into every part of the pattern cutting, so as to produce a layer of the ornamenting material of the same thickness as the plate, or nearly so, throughout the whole of the pattern cutting in the plate, and form a complete pattern upon the surface of the clay. During this process the pattern plate is held securely down upon the surface of the piece of clay to be ornamented, so that there may be no space between the under side of the plate and the surface of the clay. In order to prevent the adhesion of the clay to the under side of a plate, it may be convenient to strew over the surface of the clay a thin layer of dry powdered clay or other material, which will prevent the adhesion of the plate to the clay, without preventing the adhesion of the pattern. A pattern or patterns having been formed upon the surface of a piece of clay by means of a pattern plate in the manner just described, the plate is to be carefully detached, so as to leave the pattern or patterns upon the surface of the clay, which may, if desired, be further ornamented by having other patterns formed in like manner upon its surface. A bat or other piece of clay which has had its surface ornamented with a pattern or patterns in this way is to be placed in or upon a mould, by means of which the intended form or configuration is to be given to it with the patterns or ornamented surface against the interior surface of the mould, and the piece of clay is to be moulded or pressed into an article of the intended form in the ordinary manner with the patterns or ornaments put upon the surface of the clay, as above described, upon the exterior surface of the article when completed. In moulding the piece of clay into an article, it is necessary to avoid injuring the patterns or deranging the surface to which they are attached while pressing it into the intended shape within the mould. The patterns or ornaments upon the surface of an article ornamented and moulded in this manner will, by the force used in the moulding, be pressed into the body of the piece of clay upon which the ornaments shall have been formed, so as to cause the exterior surfaces of the patterns or ornaments to be even with the surface of the clay, or nearly so. An ornament may be applied in a similar manner to the surface of any article of earthenware (whether previously burnt or not) upon which the pattern plate can be conveniently placed, so that the under surface of the plate may come in contact with the surface of the article to be ornamented. The surface of a bat of clay may also have an ornament put upon it as follows:—Place some of the material to be used for making the pattern or patterns in a powdered state upon a table or other convenient surface, and spread it evenly upon the table so as to form a level surface upon which is to be laid a pattern plate having cut-through patterns formed in it, as above described. A bat or sheet of clay in the plastic state is then to be taken, and the surface of it which is intended to receive a pattern or patterns is laid upon the pattern plate. Pressure or rubbing is then to be applied to the upper surface of the bat or sheet of clay, so as to press portions of its under surface down into the cut-through patterns or portions of the plate, and through those portions against the powdered material below, and so as to take up as much of the powdered material as will cover the parts of the surface of the clay upon which patterns may be intended to be formed. The powdered material used to produce the pattern or patterns must be of such a nature as to be capable of adhering to the surface of the clay, and be in other respects similar to the ornamenting material above described. A bat or sheet of clay which has had a pattern or patterns formed upon its surface in this way is then to be moulded into the intended article, as above mentioned. Instead of what may be called the direct application of a pattern or patterns for ornamenting to the surface of a bat or other piece of clay, or other article, by means of a cut-through pattern plate, as above described, the pattern or patterns to form the intended ornament or ornaments, may, in the first place, be produced upon the surface of paper or other convenient thin material in like manner as above described with respect to the formation of a pattern or patterns upon the surface of a bat or piece of clay, and then, after removing the pattern plate from the paper or other thin material upon which the pattern or patterns shall have been formed, the pattern or patterns may be transferred from the paper or other thin material to the surface of a bat, piece of clay, or article to be ornamented. For this purpose a pattern deposited upon the surface of paper or other material should be placed against the surface to which it is to be transferred, and then pressure or friction is to be applied to those parts of the paper or other material which contain the pattern, so as to cause the material of which the pattern may be composed to adhere to the surface to which it is to be transferred. The paper or other thin material may be removed or allowed to remain and be burnt in the kiln.

In case of an article already formed being ornamented in the manner above described, it may be so ornamented when in the biscuit state or in a glazed state, and be afterwards burnt.

A pattern or patterns formed upon paper or other thin material, as above described, may also be transferred in like manner to the interior surface of a mould, within which a piece of clay is to be moulded into an article of the intended shape or description, taking care to place the pattern or patterns upon such portion or portions of a mould as may be proper for enabling the pattern or patterns to be afterwards transferred to the intended part or parts of an article fashioned within or by the mould. In transferring a pattern or patterns to the surface of a mould in this way, the paper or other material from which it is transferred must be removed, in order to allow a piece of clay when introduced into the mould to come into actual contact with the material of which the pattern or patterns shall be composed. When a pattern has been transferred to the surface of a mould in this manner, a piece of clay is to be introduced into the mould and moulded in the usual manner, but with sufficient pressure of the clay against those parts of the surface of the mould to which the pattern or patterns shall have been transferred, as will enable the clay to take up and hold the pattern or patterns upon its surface.

When patterns are formed upon articles not afterwards moulded, those patterns will appear in relief or somewhat raised from the surface upon which they shall have been formed.

Articles made of clay of any description, and ornamented in the manner above described, may be burnt one or more times, or otherwise finished in the ordinary way.

Patterns or ornaments may be produced upon the surfaces of articles made of slate, glass, or other material which will bear firing in like manner as above described with respect to the forming of patterns or other ornaments upon the surfaces of clay and other articles, and in such cases materials are used to form the ornaments which will, when burnt, adhere to the articles upon which they may be formed, either in a vitrified or semi-vitrified state.

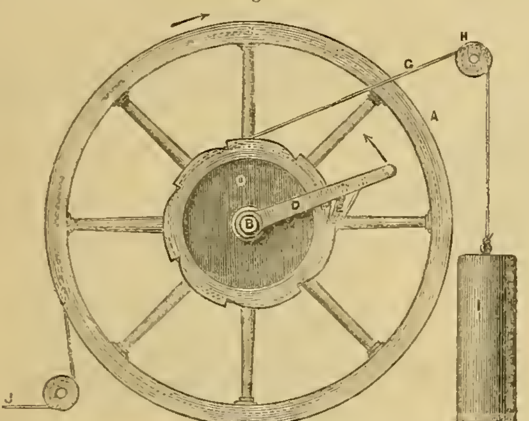
RAILWAY SIGNALLING APPARATUS.

George Richardson *and* E. D. Chattaway, *Bromley.*
Patent dated December 12, 1860.

This invention comprehends an arrangement of apparatus for enabling the guard of a railway train to communicate with the engine-driver, and consists: Firstly, of an improved mode of adjusting the weight for taking up the slack of the signal cord chain, or other flexible medium which serves to connect the wheel or drum in the guard's van, with the gong, whistle, or other alarum signal on the engine or tender. Secondly, of a peculiar construction and arrangement of the gong or alarum apparatus.

Fig. 1 of the subjoined engravings represents a side elevation of one arrangement of the apparatus for taking up the slack of the signal cord, and fig. 2 is a side elevation of a self-acting gong, constructed for giving audible signals. In figs. 1 and 2, the wheel or drum, A, is supported on a fixed stud or pin, B, secured to the side of the guard's van, and it has fitted on to, or formed in one piece with the nave or boss, a small grooved pulley, C. In front of this pulley is fitted, so as to turn loosely upon the outer end of the stud, B, a winch handle, D, provided with a spring pall or detent, E, taking into notches in the periphery of the pulley, C, and also provided with a pin or eye to which the end of the compensating cord, G, is attached, the other end of the cord being passed over the guide pulley, H, and carries a counterweight, I. J is the usual signalling cord which is wound round the wheel or drum, A, and extends along the train to an alarum apparatus on the engine or tender. On turning the handle, D, in the direction of the arrow, the compensating cord will be wound one or more times round the pulley, C, which is grooved to receive it, and on bringing the spring pall, E, into one of the notches in the pulley, the handle will be coupled therewith, and the tendency of the cord, C, and weight, I, when the apparatus is released, will be to turn the wheel, A, in the direction of the arrow, and so take up any slack in the signalling cord, J. When the train is broken up at a terminus, or one or more carriages are to be detached at any intermediate station, the signalling cord, J, is wound up wholly or partially, as the case may be, by turning the wheel, A. In another modification, a vulcanized India-rubber spring is substituted for the compensating cord and weight; one end of this spring is secured to a barrel on the nave or boss of the wheel, A, whilst the other end is hooked to an adjusting lever handle, provided with a detent which takes into the notches of a quadrant. It is obvious that on winding the spring round the barrel in the proper direction, it will tend, by its recoil, to turn the wheel, A, and so keep the signal cord, J, at a proper tension. When the cord, J, is to be wound up, the spring is unhooked from its lever, and the wheel, A, is then rotated in any convenient manner, so as to wind up the signal cord. The handle serves also to regulate the tension of the spring. The gong, represented in fig. 2, is mounted upon a plate, L, which is dropped into a frame or holding grooves on the side of the tender or engine. M is the bell or gong which is struck by the end of the rod, N, when the cord, J, is pulled. This rod is fitted in the lugs or support, *a*, and is surrounded by a helical spring, *b*, which causes it to strike the gong when released. The opposite end of the rod, N, has an eye or pin formed in or attached to it, in to or on to which the hook, O, engages, as shown in the drawing. This hook is hinged by a pin joint to the end of the spindle, P, also sliding in lugs or supports, *c*, and acted upon by a spring, *d*. The rear end of this spindle is connected to the signal cord, J. *e* is an incline made on the underside of the hook, so that as the hook is drawn back by pulling the cord, J, it will rise gradually out of the eye in the rod, N, and ultimately release that rod, whereupon the spring, *b*, will instantly force it forward, and cause it to strike the gong. The cord, J, being again released, allows the spindle, P, to slide forward under the action of its spring, when the hook again engages itself with the eye in the rod, N, and is held so, engaged by the action of the right angled projection, *f*, formed on the hook, which projection is pressed against the side of the support, *c*, by the spring, *d*, and so prevents the hook from rising or becoming accidentally detached from the rod, N.

Fig. 1.



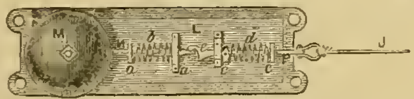


Fig. 2.

MACHINERY FOR SHAPING METALS.

J. H. Johnson, *London and Glasgow*, (H. Petin Gaudet & Co., *Paris*). —*Patent dated 27th September*, 1860.

A peculiar system or mode of shaping metals is specified under these letters patent, by forging and rolling the same, which system or mode is advantageously employed in the manufacture of railway wheels, and axles, buffer-heads, door-hinges, the frames or holders for break-blocks, break-levers, guard-plates, shovels, spades, trowels, scythes, and, in general, all articles of a symmetrical form. The rolls are suitably constructed, according to the shape of the article to be produced, which rolls have a progressive alternating motion imparted to them, in lieu of a continuous rotatory motion, as heretofore. This progressive alternating motion is derived from a vibrating lever keyed on to a rocking shaft, which also carries a large spur-wheel for transmitting its motion to the gearing of the rolls. The vibrating lever is actuated by a rotating crank and connecting rod, and the gradual progressive motion of the rolls is obtained by increasing gradually the throw or stroke of the vibrating lever. This is accomplished by connecting the end of the connecting rod to a nut working on a screw-spindle, which extends along the lever, and which is rotated a certain amount at each stroke by a pair of bevel-wheels, and a reversing pall and spur-wheel, the direction of rotation of the screw depending upon the position of the pall. As the nut travels towards, or from, the free end of the lever, it follows that the stroke of such lever will be gradually diminished or increased, the lever being thereby virtually lengthened or shortened; and this variation of motion is imparted, in a proportionate degree, to the rolls, which receive a partial circular reciprocating motion on their axes, but which motion gradually increases in extent at each stroke.

In applying this system of rolling to the manufacture of a solid railway wheel, for example—that is to say, a wheel made without arms or spokes—are first prepared in the shape of two discs. These are heated at the centre, or boss, and are placed together in a matrix, and welded together at the line of junction by the blows of a steam hammer. In this matrix is fitted a mandrel, which is cylindrical at the part corresponding to the interior of the nave, or boss, slightly tapered at the upper end above the nave, and conical also at the part where it is fixed into the matrix, in which it is retained by a key at its lower end, this key being withdrawn, so as to allow the mandrel to drop out when the wheel is to be removed from the matrix. The two discs being thus welded together, they are allowed to cool, and the rim is then applied. This is effected in the following manner:—The rim consists of a wrought iron ring, which, after being heated to a welding heat, is placed in the matrix, and the wheel adjuster thereon. A few blows of the hammer welds the rim on to the wheel, and simultaneously shapes the upper side of the rim similar to the lower side, the upper die, or matrix, being suitably formed for that purpose. It may be observed here, that the central mandrel is not required in the operation above referred to. The two portions of the wheel may be welded together at the same time that the rim is formed, the rim forming a part of the discs themselves; or the two halves may be made after the central boss has been welded, the edges of the discs being secured together by rivets, and the rim secured also by rivets. The method adopted for making the discs before referred to as forming the two halves or sides of the wheels, is first to form a circular blank, which blank is heated, and passed between the rolls, such rolls being gradually approximated, until the blank is reduced to a thickness, say, of about half an inch, care being taken to change the direction of the rolling by rotating the blank, particularly after each passage through the rolls, in order to preserve its circular form. These blanks are then cut to a perfect circle, and are shaped, or disced, and provided with central bosses, by means of suitable dies or matrices. This peculiar system or mode of rolling discs constitutes the essential feature of novelty in the manufacture of railway and other disc wheels. Of the rolls so employed one is perfectly plane and cylindrical, whilst the other has a channel or sunk portion in its centre, the section of which corresponds to the outline or contour of the raised boss in the centre of the blank. This blank, in order to attain its proper thickness, is passed several times through the rolls, which are brought nearer together at each passage, the blank being turned about one-eighth of a revolution when it is intended to pass it eight times through the rolls, or one-tenth when ten passes are required; the object being to roll out the disc evenly in all directions, and so preserve its circular outline. But it will be readily perceived that the sides of the channel which forms the boss will leave corresponding marks on the inner surface of the blank, a fresh mark, or ridge, being formed at each passage and change of position of the blank, forming, in the end, a number of radiating ribs, corresponding in number to the number of times the blank has been passed through the rolls, and therefore it would necessitate an infinity of passes before a plain and even surface could be obtained Further, it is hardly possible to present the blank to the rolls so that its boss shall correspond exactly to the channel or groove, and it is als almost impossible to turn the blank each time the same distance. The internal face, therefore, of the blank and of the boss would consequently present an irregular appearance. The rolling apparatus has been therefore modified, so as to overcome these objections, and enable a variety of articles to be constructed on the above mentioned principles. These rolls, in place of rotating, in most cases reciprocate, but with a progressive motion. The lower roll is provided with a rectangular groove or channel. in which is inserted an iron or steel bar, which must exactly fit the groove. Near the longitudinal centre of the bar is a recess, or matrix, the form of which corresponds exactly with the exterior form of the nave, or boss, on one half of the wheel. In the centre of this matrix there is a mandrel, which is to be introduced into the aperture in the boss. The upper roll is plain, since the external surface of the disc is intended to be plain and smooth. This bar is supported on either side of the roll by the supplementary rolls, the diameters of which coincide with that of the under roll.

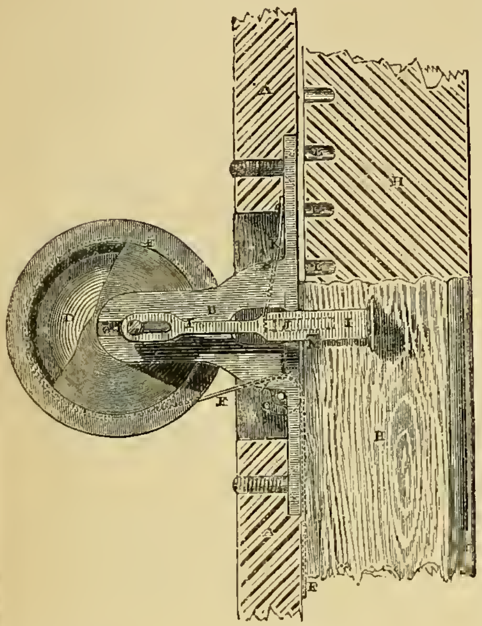
SASH LIFT AND FASTENER.

Robert Smellie, *Lanark*—*Patent dated Jan.* 11, 1861.

The improvements specified by Mr Smellie consist of a spring movement and lock or detent catch for operating sash windows and other generally similar sliding or traversing details.

Fig. 1 of the accompanying engravings is a partially sectional elevation of the apparatus. Fig. 2 is a corresponding transverse sectional plan. The apparatus is let into a slot or recess formed in the casing, or guide-part, A, of the window-framing. A slot is formed in the wood work so as to admit of the pulley passing through the opening, and of the face plate of the bracket, B, being arranged flush with the surface of the casing, to which it is secured by screws. The horizontal cheek plates which form the main portion of the bracket, B, have a slot formed at the end of each, in which is fitted the stationary stay piece or spindle, C. To this stay is fixed one extremity of the convolute spring, D, the other end of the spring being made fast to a shed inside the rim of the pulley, E, which is by preference made of metal, and it forms a box or receptacle for the spring, D. The pulley, E, rotates on the spindle, C, and to the periphery of the pulley is attached one end of a leather strap, F, which is wound on to the pulley. The other end of the strap is passed over an antifriction roller, G, the spindle of which is carried in laterally projecting bracket pieces, cast on the inner part of the face plate of the bracket B. The end of the strap is carried through a slot made in the face plate, and is then secured to the lower part of the sash frame, H. A vertical groove is formed on the inner face of the sash frame to admit of the strap or other attachment traversing freely and without check therein. In lieu of a leather strap, hemp or wire cord, india rubber banding, or other suitable material, may be used for the purpose of connecting the pulley, E, to the sash frame. When the bottom sash of the window is closed, the strap, F, is drawn off from the pulley, and this has the effect of coiling up the springs, D, to a further extent around the spindles, C, so that when the sash is opened, the reaction of the spring winds up the strap, F, on the pulley, E, and thus greatly assists the raising of the sash. A corresponding arrangement of the apparatus is fitted in conjunction with the upper sash of the window. The strap is fastened to the lower part of the sash, so that when the sash is lowered the strap is drawn off the pulley, and the spring is wound up to a corresponding extent. Upon raising the sash to close or partially close the window, the reaction of the spring assists the operation, the difference in the arrangement of the lower sash being that the spring assists the opening of the sash; in the upper one it assists in the closing of the window. In other words, the springs are arranged to assist in overcoming the gravity of the respective sashes, and so lessen the amount of force ordinarily required to operate them. The apparatus also provides for firmly holding the window at any required height, from which it cannot be moved until the spring catch, which holds the sash, is liberated. The bracket, B, has fitted to it a retaining catch, I, the end of which is slotted and connected loosely to the bracket to admit of its sliding to and fro. The outer extremity of the catch projects out in front of the sash. The catch has cast on it a laterally projecting pin, J, the free end of which is bent at a right angle, and passes through an aperture in the face plate of the bracket, B. The lateral portion of the pin, J, has pressing against it a flat blade spring, K, the upper extremity of which is screwed to the back of the face plate. The pin, J, is kept free of the sash when required by pushing back the catch with the hand, which causes the notch, M, to catch on the edge of the slot in the face plate through which the catch passes. So long as the catch is retained in this position, the sash is free to slide up and down; but when it is desired to stay the window at a certain part of its ascent or descent, the catch is liberated by slightly raising the knob at the end, and the pin, J, springs into one of the holes, M, as the sash passes up or down. These holes are made in the side of the sash at regular distances asunder, and it is obvious that while the pin, J, remains in one of the holes, the sash can neither be moved up or down; and if the sashes are so arranged that when both windows are closed, the pin, J, of each apparatus is in a contiguous hole in the sash, it follows that both sashes will be perfectly secured, and require no other kind of fastening. To counteract the tilting effect of the straps, F, being on one side only of the sashes, a small antifriction roller, or flat spring, is fitted on the opposite side of the sash frame, which causes it to slide freely up and down. The apparatus, with trifling modifications, is also applicable to the raising and fixing of carriage windows. In this case the spring pulley is arranged in the carriage door, and the band or other detail carried down to the sash. The spring catch for fixing the window is placed near the lower part of the opening in the door, so as to retain it at any desired height. Such an arrangement in railway carriages possesses many advantages over the modes at present in use.

Fig. 1.



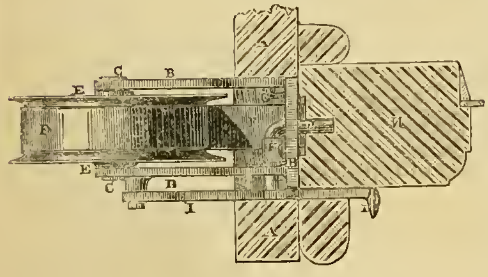


Fig. 2.

FELTED AND TEXTILE FABRICS.

J. H. JOHNSON, *London and Glasgow*, (IMBS, BROTHERS & Co, *Paris.*)—*Patent dated December* 18, 1860.

UNDER these letters patent is specified the manufacture or production of a new compound fabric, the object of the invention being the manufacture of thick and warm fabrics in an economical manner, by combining a warm or reticulated fabric with fleecy wool, wadding, or other carded or similar material, capable of being felted. The union of the woven or reticulated fabric with the felting material is accomplished by the aid of a sewing machine, the compound fabric so obtained being subsequently consolidated by being subjected to the action of an ordinary fulling mill, which thoroughly incorporates the felted material with the woven or reticulated fabric, thereby producing one body or thickness of cloth. In carrying out this invention in practice, one or more sheets or layers of wool, wadding, or other suitable material capable of being felted, are laid upon a woven fabric, and are stitched or sewn thick by means of a sewing machine suited to the purpose. This operation produces a more or less solid and united fabric, which is subsequently "fulled" or "milled" in the ordinary manner, the wool, wadding, or other material forming the surface or face of the cloth, penetrating the interstices of the woven fabric, and becoming thoroughly and inseparably incorporated therewith. According to the article to be produced, the woven fabric is composed of a material capable of being more or less felted with the sheet or sheets of material, so as to obtain either a compound fabric which is plain and smooth on its face or right side, whilst the under or reverse side thereof consists of a soft or felted material, or a compound fabric, having both surfaces composed of woven fabric, with an intermediate layer of felted material, or a fabric having both surfaces composed of felted material, and an intermediate layer of woven fabric as a foundation. The stitches which unite the layers composing these fabrics are more or less concealed by this peculiar combination, and by the subsequent process of "milling" or "fulling" This combination affords facility for producing a variety of new fabrics, having the advantages of presenting the solid or close, and even surface of a woven fabric on one side, and the softness and warmth of a felted fabric on the other side. Or, in lieu of a loose felting material being used, two or more thicknesses or layers of woven fabric may be laid together and united by sewing, and subsequently incorporated into one thick compound fabric by fulling. Moreover, by varying the materials and colours on each face, fabrics will be obtained of an appearance and quality not hitherto attained, which will be applicable to various useful purposes, such, for example, as substitutes for carpets, cloth for boots and shoes, articles of wearing apparel, and knitted goods.

SMOOTHING IRONS.

J. H. JOHNSON, *London and Glasgow*, (A. J. A. C. DE MACOMBLE, *Paris.*)—*Patent dated December* 26, 1860.

THIS invention relates to a new and improved form of smoothing iron, and in arrangements for rendering them self-heating.

Fig. 1 of the accompanying engravings represents a longitudinal vertical section of one modification of the improved self-heating smoothing iron, which the inventor calls the "Janus Iron," and fig. 2 is a back elevation of the same at right angles to fig. 1, with the reservoir of the lamp removed. The smoothing iron is composed of three parts, namely, the smoothing iron, proper, A, with its two faces, *a*, which may each be used alternately in ironing; the wooden handle, B, the front support, C, of which is connected to the part, *d*, of the iron, A, by means of a pin, bolt, or other suitable contrivance; and the lamp, E, with its conducting tube, F. The lamp, E, is connected to the lamp-holder, G, by means of the circular plate, H, which is provided at its periphery with stop notches or recesses. This plate, H, fits into notches or slots in the annular frame, G, which is formed behind the three projecting legs, *l*, and is held firmly in its position by the moveable stop, *m*. The stop, *m*, is actuated by pressing the upper end of the lever, M, towards the handle of the iron, a spring, N, serving to push it in the opposite direction, and to keep it in such a position as will maintain the stop, *m*, in the slot or opening, *p*, in the back end of the iron. The frame, G, is kept in its place by a screw bolt which passes through the upper end of the front and back frames, C and G, and also the centre of the wooden handle, B. The stop, *m*, which passes through a notch in the frame, G, enters an opening, *p*, made for that purpose in the back of the iron, thereby holding it in its proper position, but admitting of it being turned over or reversed when withdrawn from such opening, *p*, by pressing inwards the upper end of the lever, M, the iron being again fixed in its reversed position by the entrance of the stop, *m*, into a corresponding opening, *p*, made on the opposite side of the iron. The conducting tube, F, has a wick (not shown in the engraving) passing through its entire length, for conveying the spirits from the reservoir to the inner end, which is fitted with a screw cap, *r*, to prevent any volatilisation of the spirit which supplies the wick. The reservoir, E, of the lamp is provided with a stop-cock to regulate the flow of the wick in the tubular branch, P, which is screwed at its lower end, whilst the end of the wick tube, F, carries an enlargement, in which is inserted a piece of hard wood, Q. This piece of wood, Q. is screwed to receive the screwed end of the branch, P, of the reservoir, which is thus kept cool as the interposition of the non-conducting substance, Q, prevents to a considerable extent the transmission of heat thereto. Various means may be adopted for fixing the wooden nut, Q, inside the enlarged socket, *f*, or this nut, Q, may be replaced by a series of washers of leather, India rubber, or other good non-conductor of heat, placed over above the other. In this latter case a different mode of conducting the branch, P, may be employed. The supply of air to the flame of the lamp should always be at the ends of the iron, either by means of round or oval apertures made in the sides of the iron behind, or in front of the flame, or by means of orifices formed at the two ends of the iron, as shown at X and Y in fig. 1. Air may be allowed to enter the back end of the iron by leaving a space between the disc, H, and the frame, G, as shown at fig. 2. There are other arrangements described in this patent for conveying and regulating the flow of spirits, one of which dispenses with the branch pipe, P, and regulating stopcock by carrying the pipe, F, up to the top of the reservoir, and allowing the wick to hang down into the spirits, which rises through it by capillary attraction. The end of the tube, F, at which the wick enters, being fitted with a screw cap, which, by its pressure against the wick, regulates the flow of the spirits to be burned.

Fig. 1.

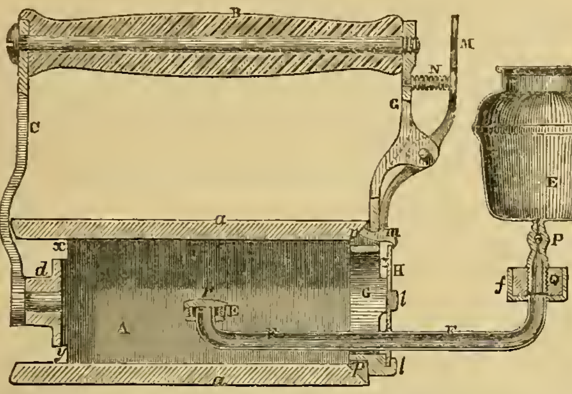
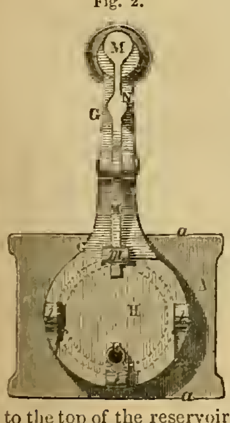


Fig. 2.



ACOUSTIC INSTRUMENTS.

J. H. Johnson, *London and Glasgow*, (Charles Grafton Page, *Washington, U. S.*).—*Patent dated December 26th*, 1860.

This invention relates to a new form of instrument for assisting the sense of hearing, consisting of a small hollow chamber, surrounding the ear, and having projecting forwards from it the segment of a hollow cone, which conveys or deflects the sound into the chamber, and thence to the ear; one of these instruments being arranged in a convenient manner over each ear by being attached to a hat, or by a light spring over the head. Fig. 1 is a back elevation of the instruments, as attached by a light spring bow, which passes over the head to hold them in their place. Fig. 2 is a horizontal section of the instrument to a larger scale than the combined view, fig. 1. The deflector, A, is attached to and conveys the sound to the hollow chamber, B, which encloses the ear by the edges, *b*, lying close to the head; a hand, D, in the form of a bow, is attached to two buckles, E, on the outside of the cone piece, A, near the chamber, B; this bow passes right over the centre of the head, and keeps the two instruments in proper position. The deflector, A, is constructed on the principle of a conic section, and such as to prevent, as much as possible, repeated reflections in the instrument itself, or between it and the head and parts of the ear, as the " roar " or continued murmurs, so objectionable in other devices, is due to repeated reflection or reverberation. A variety of forms will suffice to deflect vibrations in such a manner as to augment sound, but there are certain characteristics essential to the best effects to obviate these injurious sounds, so as to enable the ear to discriminate sounds, and one which may be best understood by common phrase is the "open flare," which obviates double reflection or reverberation. It is also of importance that the deflecting surface terminate in conformity with the line of the cartilaginous ridge which circumscribes the central opening of the ear, so as to prevent the passage or escape of ærial vibrations beyond that line, for that, in fact, is the natural limit of the sound-gathering function of the external ear. It is also important that all aerial vibrations from behind should be intercepted, and that the instrument should be so constructed as to close well upon the ear behind, so as to intercept interfering sounds, and insure the reflection of vibrations from before, and deflect them to the external meatus. The main portion, A, of the deflector forms a conic section; but, for the purpose of complete reflection to the external meatus, the deflector takes a curvilinear form at or about the part, F, fig. 2. A plain surface in lieu of the curved surface would have a good effect, but not so good as that of the curved surface at this point. The chamber, B, is of the general outline form of the ear, and is designed to enclose or surround it completely when the instrument is in use, it being also adapted on the edges at *b* to the form of the head at that part. The chamber, B, may be dispensed with, and the deflector fitted to cover the ear from behind, thus simplifying the construction, but at some little sacrifice of the efficiency of the instrument. The deflector may (especially under the latter form) be worn in almost any position, with its open or flaring portion in front, up, down, or directly backwards, which latter position gives a good effect. The deflectors are held in their places on the head by the spring bow, D, and this bow may be adjusted so as to fit different heads, and also to adapt the deflectors to their proper position. The deflectors may, however, be so adapted to the form of the ear as to keep their places without the aid of the bow, but the bow is preferable as a means of keeping them steady. They may also be attached to a hat, or cap, or bonnet; or the rim of the hat or cap may be made of suitable form and material to answer the purpose of the deflectors; or plates of metal or other material may be worked into or concealed in the sides of a bonnet, and so adjusted as to act like the deflectors before described, care being only necessary to give them their proper position. These deflectors may be made of any firm material, and, for the sake of lightness and strength, the material known as "hard rubber" is very serviceable. They can also be made of metal, glass, horn, shell, papier mache, wood, or of any material suitably firm, and can be ornamented to suit the taste.

Fig. 1.

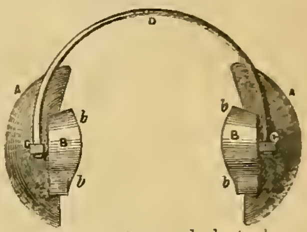
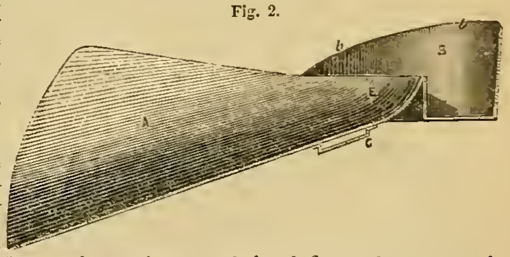


Fig. 2.



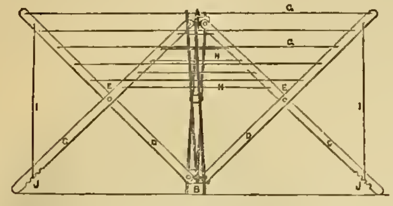
CLOTHES DRYERS.

J. H. Johnson, *London and Glasgow* (John Ward, *New York*).—*Patent dated 4th December*, 1860.

In the arrangement of this improved clothes dryer, two series of arms, each supporting several clothes lines, are hinged to each other and to connecting blocks, and are provided with tension cords, the whole being so disposed as to form a portable self-supporting clothes frame or horse capable of wide extension as compared to its height The accompanying engravings show fully the improvements specified.

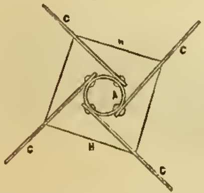
Fig. 1 is an elevation showing the improved clothes dryer in an extended condition. Fig. 2 is a plan view on a larger scale, showing one modification of the blocks or connections at the top and bottom. A and B are blocks of metal or wood in the form of a Greek cross; C and D are rods jointed together at E, and jointed to A and B in the manner represented; C being jointed to A, and D to B. The joints, E, are not in the centre of the rods, C or D, but a little nearer the ends thereof, which are united to A or B. G, G, are clothes lines attached to the rods D; H, H, are similar lines attached to the rods C, at the points represented. I, I, are lines attached to the outer ends of the rods D, and passing down beneath the ends of the rods C, and so proportioned and arranged that when slipped into the notches, J, in C, they hold the frame fully extended.

Fig. 1.



When this clothes dryer is compressed or folded together laterally, it assumes a very compact form. The frame may be extended by a gentle force applied laterally into the condition shown in Fig. 1, the ends of the rods C extending below the block B, as shown in the figure, and the whole being supported upon the ground or floor by the ends of these rods C, forms a convenient and portable frame, having a great extension laterally, but with a moderate height. It is for this latter reason especially adapted for use within dwellings where the ceilings are of but moderate height. It is readily extended by first loosing the parts by pulling them a little at the joints, E, and then planting one leg or base of C firmly upon the floor or ground, and seizing the corresponding rod diametrically opposite, pulling the two horizontally apart to its full extent, when the cords I, I, are slipped down into one of the notches, J, which fastens it in that position, and the cords G and H are loaded with clothes. The reverse of this process reduces the frame again to its closely folded condition.

Fig. 2.



A convenient size is obtained for the frame by making the rods C and D about eight feet in length, placing the joint or connection, E, three feet and ten inches from the ends that are jointed to the blocks, and allowing the frame to spread to a width of about twelve feet, measured diagonally. Thus proportioned, the block, B, will stand about three inches above the floor when the frame stands extended, thus relieving it from any bearing. The lowermost of the lines, G or H, will stand about three feet high, allowing a person, by stooping, to pass under and load the lines, H, from the inside.

In exposed situations, a cord may be attached to the block, B, and tied to a stake or other fixture in the ground, which will guard against the apparatus being moved by wind or other disturbing cause. This apparatus may be cheaply constructed, and is very strong. It exposes more line, and that more favourably for the purpose desired, than any other portable dryer of equal cost. It spreads to a greater extent laterally in proportion to its height, and allows the clothes depending from either of the lines to hang nearly to the ground without contact, either with each other or the supports.

Instead of the cruciform blocks, A B, shown in fig. 1, circular or polygonal blocks or rings may be employed if preferred, and instead of four arms in each series, a greater or less number may be used, as shown in fig. 2.

MANUFACTURE OF ARTICLES OF MALLEABLE CAST IRON.

E. B. Wilson, *Engineer, London.—Patent dated Nov.* 16, 1860.

This invention consists in manufacturing railway disc wheels and other articles of cast steel or of malleable cast iron by either forging such articles so composed in suitable dies, or by shaping them after they have been cast or forged, by the aid of suitable dies acted upon by steam power.

Fig. 1 of the accompanying engravings represents a vertical section of a pair of dies for pressing, shaping, and finishing cast steel or malleable cast iron railway disc wheels, arranged according to one modification of this invention. In this figure a wheel blank, *a*, is represented before it is pressed. Allowance is made for contraction in casting these blanks to make them of sufficient diameter to fit the shaping dies as closely as possible when placed therein. These dies are composed of two parts only, the upper part, A, shaping the inner face of the entire wheel, and the bottom one, B, shaping the outer face, tread and flange, or rim of the wheel. Fig. 2 is a vertical section of another arrangement of dies also for the manufacture of railway wheels; here the matrix or die is composed of three parts or dies, A, B, and C. The die, A, shapes the inner face of the wheel, *a;* the die, B, forms the head and flange of the wheel, and the top die, C, shapes the outer face of the wheel. The two dies, A and B, are made to fit accurately together by having a corresponding projection and recess formed on them respectively, as shown at D D, so that when adjusted, and held together by the collar bolts, E, they are in the exact position for shaping the wheel. The top die, C, is moveable, and is made to fit accurately a circular aperture in the die, B. The wheel blank having been cast in a suitable mould, is reheated and introduced into the die, A. Upon this is placed the die, B, which is then held fast down by the bolts before mentioned. The die, C, is forced down by steam power, and by its pressure upon the wheel it not only shapes the surfaces and periphery of the same by forcing them into their respective dies, but also forms the top. The die, C, has a collar or flange, *b*, cast upon it, for the purpose of being caught by the die, B, when it is elevated, so that both dies may be lifted or lowered together at one operation; ring bolts, *c*, are screwed into the die, B, for lifting the same by, and *d* are square porter bar holes for lifting the top die, *c*, only. Figs. 3 and 4 represent respectively a vertical section and plan of a set of dies for pressing the blooms intended for the manufacture of armour plates. *a* represents the bloom intended to be pressed; it may either be cast in the die or matrix, A, in which it is pressed, or it may be cast in a separate mould, and then placed in the die or matrix, A, after being

Fig. 1.

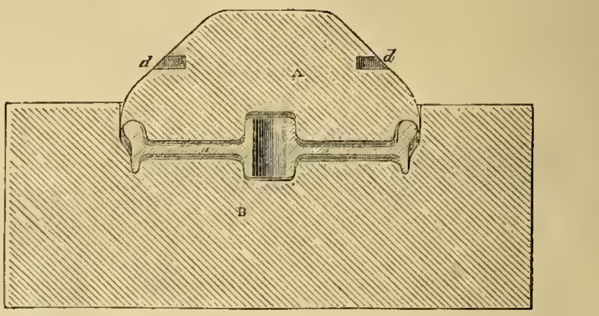


Fig. 2.

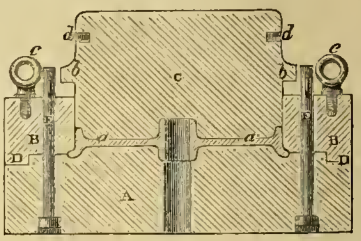
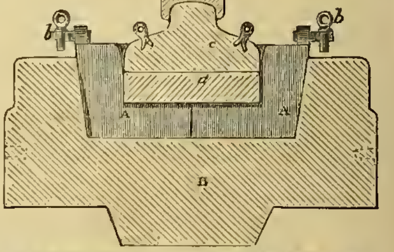


Fig. 3.



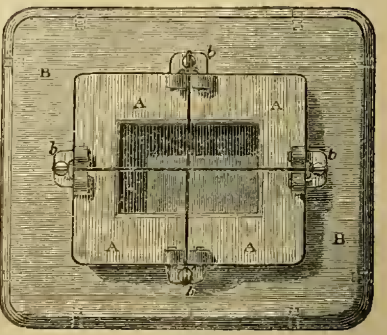


Fig. 4.

reheated. This die, A, is preferred to be made in four parts as shown, in order to facilitate its removal from the pressed and consolidated bloom or plate. The several parts may be held together by clamps, *b*, as shown, and the whole is placed or contained in a recess or cavity formed to receive it in the metal bed or block, B. C is the top or pressing die, which is made to fit accurately the cavity of the die, A. It is obvious that the same system of arrangements and compression of dies may be applied to the manufacture of various other articles of cast steel or malleable cast iron.

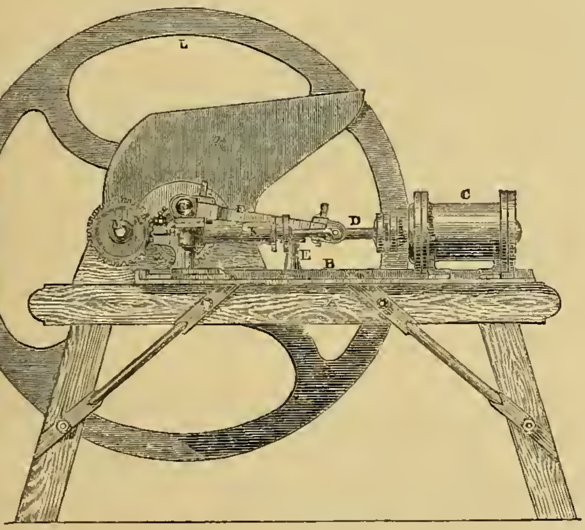
AGRICULTURAL MACHINES.

Henry & Francis C. Cockey, *Frome Foundry, Somerset.—Patent dated August* 9, 1860.

The improvements specified under these letters patent relate to a peculiar mode of driving chaff and root cutting machines, corn crushers, tile machines, &c.

Fig. 1 of our engravings represents a side elevation of a chaff-cutter arranged so as to be driven direct from a small steam engine, in accordance with this invention; and fig. 2 is a corresponding plan of the same. A is the main framing of the chaff-cutter, which may be constructed either of wood or of iron. Sufficient space is afforded in this framing for the reception of the bed plate, B, of a small steam engine, of which C is the working cylinder, disposed by preference in a horizontal position, as shown in the engravings. D, the piston rod, which is guided by working through the stationary bracket, E, bolted to the bed plate, and F is the forked connecting rod jointed to the crank, G, formed on or fitted to the end of the main shaft, H, of the chaff-cutting machine. I is the eccentric for working the slide valve, and K is a feed pump for supplying the boiler. The main shaft of the machine thus forms the crank shaft of the engine, and receives its rotatory motion direct therefrom, without the intervention of gearing or driving belts. The fly-wheel, L, which carries the knives or cutters, *l*, is keyed on to the shaft, H, and forms also the fly-wheel of the engine. The feed rollers, M, are driven from the main shaft by means of the gearing, N, and may be thrown out of action when the machine is not in use by means of a disengaging clutch. The feeding part is made to slide back a short distance, so as to be entirely out of contact with the knives as they rotate when the machine is not in action for chaff cutting, leaving the wheel perfectly free and unimpeded to act simply as a fly-wheel to the engine. The engine may then be used for driving any other machine which may be connected by universal joints, or otherwise, to the main shaft at H. In applying this invention to brick, tile, and pipe making machines, the patentees do not confine themselves to make a rotatory machine, as it may be made in such a manner that the piston or pistons for forcing the clay through the dies may be connected to the same rod as the piston of the steam engine, and be worked either with or without a fly-wheel, the chief object being the driving of such machines as above referred to, direct without the intervention of complicated gearing.

Fig 1.



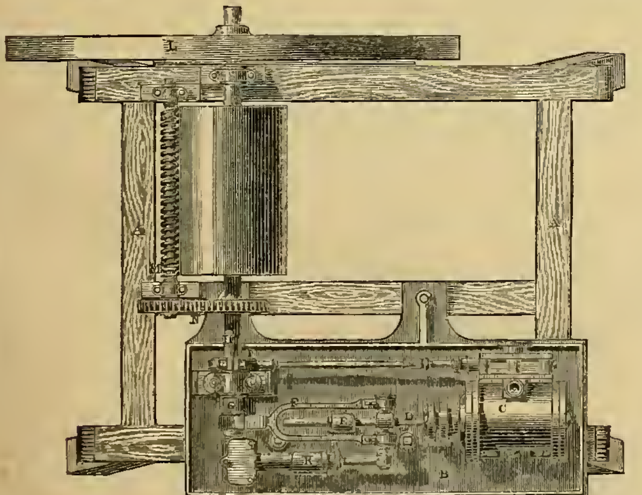


Fig. 2.

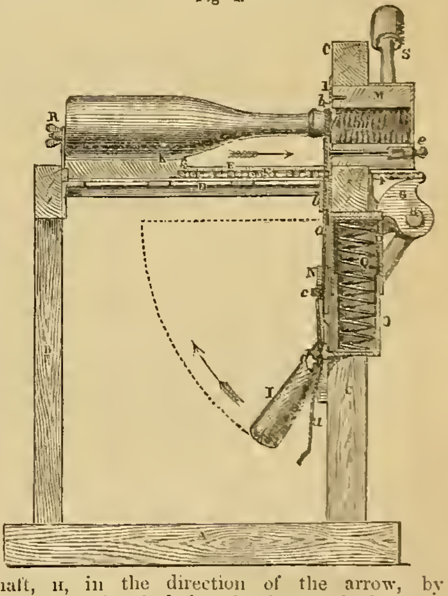
SECURING CAPSULES TO BOTTLES.

J. H. Johnson, *London and Glasgow*, (Jules Mathieu, *of Paris*)—*Patent dated June* 8, 1861.

This invention relates to a peculiar construction and arrangement of machinery, or apparatus for squeezing or nipping metallic capsules round the necks of bottles, and consists in the employment for that purpose of a series of cords attached individually at one end to a rotating disc, and at the other to a spiral spring, suitable guide pulleys being used for guiding the cords so as to cause them to unite or cross at the centre of the disc, when the latter is turned by a handle for that purpose The accompanying engravings and description shows one modification of this invention, as well as the general arrangements of the several parts.

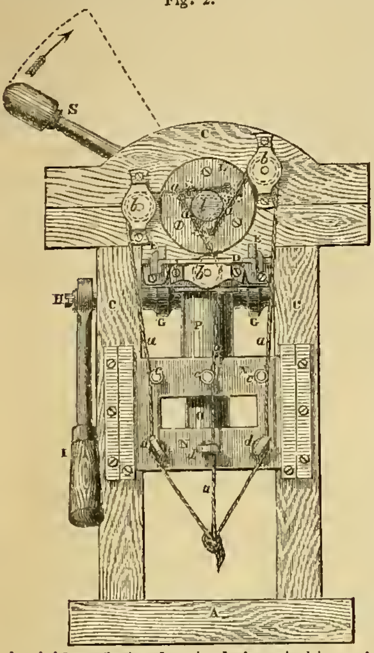
Fig. 1 is a longitudinal vertical section of the machine, and fig. 2 is a transverse vertical elevation or front view of the same, corresponding to fig. 1, with the part which supports the bottle removed for the better showing of the rotating disc and compressing cords. A is the bed or stand of the apparatus, upon which are erected the two uprights or standards, B and C. The standard, B, serves to support one end of the fixed metal frame, D, the opposite end of which is secured to the standard, C. This frame, D, carries the moveable or sliding frame, E, which slides freely upon it, one end passing through openings made in the standard, C. This end of the sliding frame is connected by two chains, F, with the segments, G, on the rocking shaft, H, so that on partially turning the shaft, H, in the direction of the arrow, by means of the lever handle, I (worked by the knee of the operator), the segments will draw forward the frame, E, and with it the bottle to be capsuled, which is laid horizontally upon the carriage or support, K, fitted to the sliding frame. This carriage may be fixed in different positions upon the frame, E, so as to suit different lengths of bottles, by inserting the holding pin, *k*, into any of the holes made in the sliding frame. L is a metal disc screwed to the face of the rotating box or chamber, M, which is fitted into the head of the standard, C. This disc has an opening in the centre, leading to the interior of the box, against which open-

Fig 1.



ing is pressed the small internal plate or disc, *l*, by the spiral spring, *m*, behind it. The object of this spring disc, *l*, is to press against the capsule, and so keep it well in its place on the neck of the bottle when the same is made to enter the box by the forward motion of its carriage or holder, hereinbefore described. *a*, are three strong cords, passing over the fixed guide pulleys *b*, and introduced into holes in the face of the rotating disc, in which they are secured at one end, whilst the lower portion of the cords is secured to the studs or pins, *c*, in the vertical sliding frame, N. This frame carries the lower portion of a telescope spring box, which portion works or slides freely within the upper and stationary part, P, of the box secured to the head of the standard, C. The action of the spring, Q, contained inside this box, serves to maintain the three cords in a proper state of tension. R, is a stop or gauge, adjustable laterally on the end of the carriage or bottle support, K, for the purpose of centring bottles of different diameters upon the carriage, so that the neck of the bottle will always coincide with the central aperture in the rotating disc, the side of the bottle being held against this stop when the bottle is adjusted in the machine, as shown in fig. 1. In securing a metallic capsule round the neck of a bottle by this machine, the capsule is first placed upon the neck over the cork, and the bottle is then laid horizontally upon its support or carriage, K. The handle, I, is now raised slightly by the knee of the operator, thereby forcing the end of the neck inside the box or chamber, M, in the disc, L, the small internal disc, *l*, pressing against the capsule, and so forcing it well home upon the neck of the bottle. The disc, L, is now partially rotated by means of the lever handle, S, secured thereto, which motion causes the cords, *a*, to close upon the capsule, assuming the position indicated by the dotted lines in fig. 2, and by exerting a pressure thereon, whilst the bottle is rotated by hand, the capsule will be effectually squeezed or nipped round the neck of the bottle, which is then removed, to be replaced by another.

Fig. 2.



LAW REPORTS.

Carpet-Design: Crane et al. *v.* Lyle et als.—This was an action for an infringement of an ornamental design for carpets, and was heard in the Sheriff Court, Glasgow, before Sheriff Strathern. Messrs Crane & Barton, manufacturers, Kidderminster, being the proprietors of a new and original design for the ornamenting of carpets—a rosebud, on a moss ground—and, having registered the said design in the usual form, according to certificate of registration, dated 27th May, 1859, presented a petition and complaint praying that Messrs John Lyle & Co., carpet manufacturers, Mile-End, Glasgow, should be found guilty of an infringement of the "Designs Copyright Act," 5 and 6 Victoria, cap. 100, entitled "An Act to consolidate and amend the laws relating to the copyright of designs for ornamenting articles of manufacture," in so far as they had applied said design, after due registration thereof, to the ornamenting of fourteen separate pieces of carpet manufactured at their works. The respondents, in defence, pled that they, in ignorance that the design was registered, merely executed three orders given to them by Messrs Stewart & M'Donald, warehousemen, Glasgow, who supplied them with the pattern; that Messrs Stewart & M'Donald had already paid the complainers £60 as penalties for having caused the said pieces of carpet to be manufactured, and that the manufacturing or causing to be manufactured was only one, not separate offences, under the statute. Proof having been led, and parties heard, Sheriff Strathern, in giving judgment, said that he considered the words of the statute "no person shall either do, or cause to be done," capable of only one reading, and that in the execution of an order both the giver of the order and the manufacturer may be liable; the doing and the causing to be done, being, in his opinion, separate and distinct offences. Upon the question as to the number of penalties incurred, his Lordship said that he could not view the fourteen separate pieces manufactured as fourteen separate infringements of the statute, as, on the same ground, each yard manufactured might be held to be a separate act of offending. He considered that as these fourteen pieces had been made in fulfilment of three separate orders, the respondents could be found liable in only three separate penalties; and as there was evidently no *mala fides* on the part of the respondents, he would limit the penalty to the minimum allowed by the statute. The following is his Lordship's interlocutor :—

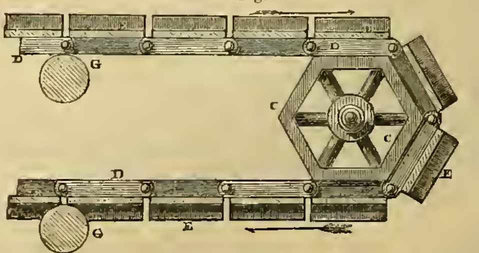
Finds it proved, by the minute of admission of parties and the evidence of credible witnesses adduced, that the petitioners, Crane & Barton, are proprietors of a new and original design for the ornamenting of carpets—a rose-bud, on a moss-ground—which was, prior to publication, registered, on the 27th day of May, 1859, in terms of the Act 5 and 6 Victoria, cap 100, and that since the date of said registration all the carpets ornamented with the said design, which have been manufactured or sold by the petitioners, have had put thereon the marks denoting a registered design, as required by said Act, by attaching thereto a label containing such marks: Finds it further proved, *ut supra*, that without the license or consent in writing of the said petitioners, Crane & Barton, the respondents, John Lyle & Co., complained against, in the months of August, September, and October, 1860, and January and March, 1861, did, within the City of Glasgow, in the said county, apply the said design, for the purpose of sale, to the ornamenting of 14 pieces of carpet as libelled; and finds that said pieces of carpet were woven and made in part fulfilment of three separate orders for the manufacture of three beams' length of carpet, each containing five pieces, and each piece containing 42 yards, previously given by Messrs Stewart & M'Donald, warehousemen in Glasgow, to, and accepted by the respondents, John Lyle & Co.: Finds that by so applying the said design to the pieces of carpet manufactured under, and in fulfilment of, each of said three orders, the respondents, John Lyle & Co., have been guilty of three separate acts of contravention of the seventh section of said Act, and have forfeited for each of said offences, the penalty concluded for and prescribed by the eighth section of said Act: Therefore I do adjudge that the said respondents, John Lyle & Co., for each of the said three offences, have forfeited the sum of £5 sterling, in name of penalties, to the petitioners, Crane & Barton, together with the expenses.

Alex. Strathern.

Neville *v.* Wright.—Annealing Glass.—This was an action brought by Mr Samuel Neville of Gateshead against Mr William Wright of Newcastle-upon-Tyne for an alleged infringement of a patent obtained by the former for improvements in machinery or apparatus employed in the annealing of glass and the firing of pottery ware. This patent was dated the 21st of January, 1857. A few months subsequently, namely, on the 9th of June, 1857, Mr Wright, the defendant, obtained a patent for improvements in apparatus for annealing glass in ovens, and his apparatus was, it was alleged, an infringement of Mr Neville's invention. The case came on for trial in March last at the Newcastle Spring Assizes before Mr Justice Hill and a special jury. Mr Temple, Q.C., Mr Monk, Q.C., and Mr Hindmarch, were counsel for the plaintiff; and Mr Manisty, Q.C., and Mr Webster, instructed by Mr J. Henry Johnson, of 47 Lincolns-Inn Fields, appeared for the defendant.

The process of cooling glass requires to be conducted very slowly, otherwise it will be very fragile, and is utterly useless for all practical purposes. The operation of the annealing of glass, as it is called, has been attempted to be carried out in various ways; but one thing is essential to every method, namely, the slow and gradual reduction of the temperature. The plan adopted by Mr Neville will be better understood by reference to the annexed wood-cut.

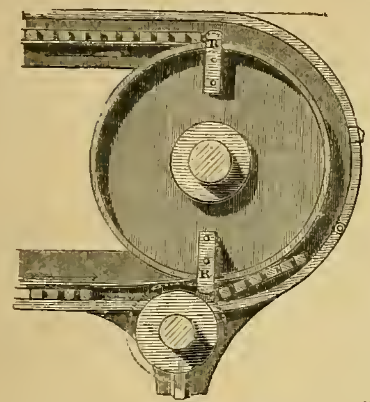
Fig. 1.



A number of plates or vessels, E E, technically called lear pans, holding articles to be annealed, were arranged in the form of an endless or continuous table made to travel by means of the hexagonal rotating wheels, C C. The requisite motion was communicated by a winch handle or otherwise. The lear pans being secured to the chains, D D, pass over the rollers, G G. Motion being communicated to the end wheels, the articles in the lear pans are conveyed at the desired rate of speed through the bar in the direction of the arrows from the end where the greatest degree of heat exists, to the opposite end where they are taken off.

It was intended that the pans should be again returned to receive a fresh hcarge without being removed from the lear or oven.

Fig. 2.

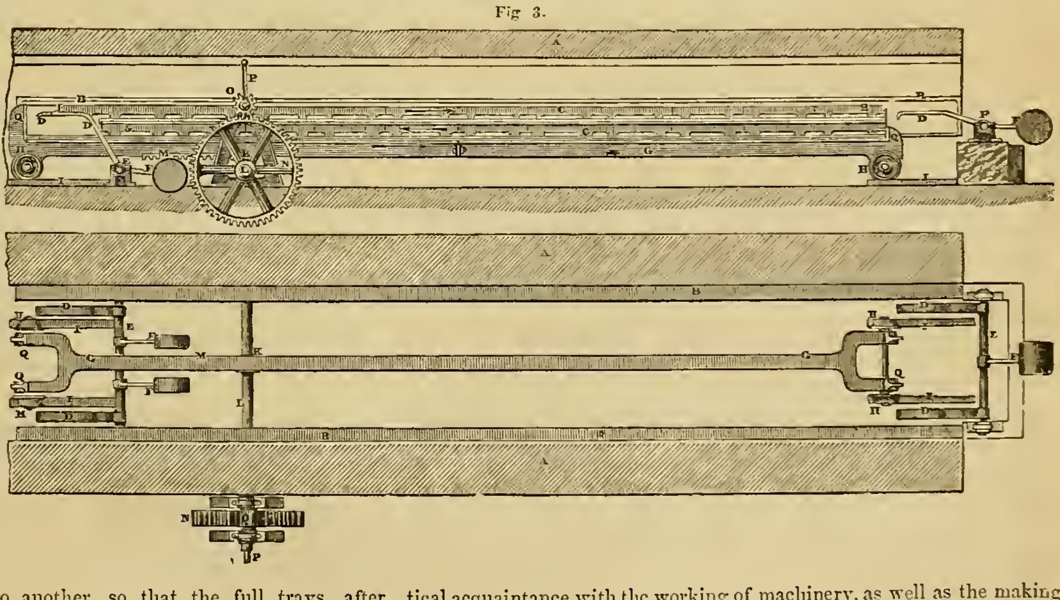


Another of the plaintiff's schemes is represented in fig. 2. Here the pans coming underneath were intended to be pushed up one by one by means of one of the bolts or arms, R, attached to the revolving wheel on the right, and as they were brought to the top they were pushed against the upper series of pans. The pressure at this side of the series was intended to act so as to push along the whole series of upper pans and force those at the other side over the opposite wheel (not shown in the woodcut). In this way it was thought that a slow and constant revolving motion could be maintained.

The plaintiff's claim, as modified by a disclaimer afterwards filed, was for the employment of lear pans attached to endless chains or bands, or otherwise combined so as to form an endless table, or a continuous table, for receiving the articles to be annealed, and the employment of lear pans caused to travel from end to end of a bar to receive and discharge their load as described in the specification.

Mr Wright adopted a system of passing lear pans through bars by means of a rod or bar, or chains fitted with suitable projecting arms, and having a longitudinal reciprocating or vibratory motion imparted thereto by some convenient arrangement of mechanism. He also showed a mode of raising and lowering the lear pans from one series of traversing grooves to another by means of moveable tables. His invention was patented on the 9th of June, 1857, and was described as relating to a mode of imparting motion to or of passing the annealing trays from one end of the lear to the other. It consisted in the employment for that purpose of a rod passing underneath the trays, and so contrived as to travel to and fro longitudinally throughout the space of the length of one or more trays. The trays were placed upon frames or floors so as to move freely lengthways, in which direction they are impelled by the action of the rod, which was actuated either by a crank, or by means of a rack and pinion motion. The trays were disposed in two tiers, the upper one being intended to contain the articles to be exposed to the action of the lear, and were moved forward the extent of one or more trays by the action of the vertical arm or arms on the end of the rod nearest the fire. The lower series of trays was moved backwards by the reverse action of the rod, which has a shorter projection made for that purpose on its opposite end. At each end of the series of trays is a table actuated by weights, springs, or inclines; or an arrangement of weights or springs without a table might be used for raising and lowering the trays from one series to another, so that the full trays, after having passed successively along the whole length of the apparatus, were emptied and transferred successively to the lower or empty series, whereupon they were returned back again to the other end of the lear to be recharged. The above wood-cut, (fig. 3) and reference to the *Journal* for April, 1858, p. 16, will render this description more intelligible.

Fig 3.



The plaintiff contended that the defendant employed a continous chain, which he had no right to do, although he might use a different mode of raising the pans from the lower to the higher tier. It was argued that this variation did not give the defendant the right of using the continuous chain, that being an essential part of the plaintiff's plan. He moreover contended that the merit of his invention was that he had shown a mode by which the pans could be raised from the lower to the higher level. A better mode than his might perhaps be devised, but no one had a right to adopt all the rest of his scheme and merely substitute another plan for elevating the pans. It would clearly be an infringement if the defendant had borrowed a new and useful part of the plaintiff's apparatus, and had added to it something of his own. The questions to go before the jury, as the plaintiff's counsel opened the case, would be whether in point of fact the plaintiff's arrangement for using a continuous table was a new and useful part of the invention, and whether it had been incorporated by the defendant in his process. If they answered these questions in the affirmative, there must be a verdict for the plaintiff.

A good deal of remark was made that the plaintiff prodnced no models, and the judge observed that without models such a case was quite unintelligible to persons unacquainted with the machinery in question.

After the plaintiff had been examined, several scientific witnesses were called on his behalf, from one of whom, Mr F. Bramwek, it was elicited that there was some fear, looking at the drawing attached to the plaintiff's specification, that the table in moving round the ends would lock. The defendant's counsel, on the other hand, contended that the plaintiff's specification was to be read as claiming simply a peculiar mode of obtaining continuity of motion for the pans; and that, as the defendant had adopted another mode of arriving at the same result there was no infringement. They also contended that, if the plaintiff claimed every mode of raising the plates from the lower to the upper tiers, he claimed too much, and his patent would be bad. The first of these objections the judge ruled against the defendant, but gave him leave to move. Of the second he took a note. In the progress of the case, the principal ground of contention was whether the plaintiff's apparatus, as described by him (fig. 2) would work; in other words, whether it was practicable and useful, and therefore, whether his patent was good. If this part of the invention was impracticable, the defendant could have committed no infringement even if he had copied, which he disavowed, any part of the plaintiff's apparatus.

Mr James Nasmyth, and other witnesses, were then called on behalf of the defendant, and they deposed that, in their opinion, the working of the plaintiff's apparatus (fig. 2) would be practically impossible, not only from the weight and friction of the plates required to be moved over a long level surface, but from the difficulty of getting the plates round the corner, where they would lock. If the drawings, said Mr Nasmyth, were to be submitted to any man of common sense, who had the slightest practical acquaintance with the working of machinery, as well as the making of it, and if he were desired to undertake the construction of the apparatus, he would decline to do so, if he had the slightest regard to his reputation, for it would end in utter failure. The judge then addressed the jury, and said: There are two questions which I shall leave to you. They are but one in substance, but for the sake of form, I put them in two distinct questions. I first ask you, Whether the mode pointed out in the specification, and drawings three and four (fig 2), is practicable? and, secondly, Whether that part of the plaintiff's invention, infringed by the defendant, was new and useful. There is no question that it was new. It really turns on the latter point, was it useful? It resolves itself into the one question, whether that part of the second invention mentioned in the plaintiff's specification is or is not practicable. You will observe that the patent is not for a simple machine, but for improvements in machinery, or apparatus employed in the annealing of glass; and the defendant is not alleged to have infringed the whole, but to have infringed a part. Many a man takes out a patent for a combination, and he charges another with infringing that patent, that other having infringed only a part. To make a good ground of complaint the part infringed must be new and useful; and the part infringed here is that part contained in the second portion of the plaintiff's invention with regard to a continuous table of pans. There being two distinct parts of the invention, the one pointed out in the woodcut, relating exclusively to endless chains or bands combining plates together, and the other relating to a continuous table of plates There is this one fact which I think you ought not to lose sight of. Here we are in the year 1861, and this patent was taken out in the year 1857, and there is no man living, according to the evidence before us to-day, who has ever seen that part of the invention contained in drawings three and four (fig. 2) in operation. Certainly, one would expect that if it were a useful practical invention some one or other would have seen it in operation, either at the patentees or elsewhere; but so it is, the patent is taken out in 1857, and in 1861 you are trying the question whether an essential part of it is new and useful, and no one has seen it in operation. I mention it, because I think you ought to give some weight to that fact.

After having recapitulated the testimony of the witnesses on both sides, the judge left it to the jury to say whether the mode pointed out on the specification and drawings three and four (fig. 2) is practicable, and whether that which the defendant had infringed was new and useful. After half-an-hour's consideration, the jury found on both questions for the plaintiff. The judge thereupon gave the defendant liberty to move on the points reserved, and he has since moved accordingly.

Purification of Gas: Hills v. Evans.—*In Chancery before the Lords Justices.*—This was an appeal from a decision of V.C. Wood on the patents of Mr Frank Clark Hills and Mr Frederick John Evans, brother of the defendant. The V.C. had decided that Mr Hills' patent had been infringed by Mr Evans. Since the time when Winsor discovered that coal gas could be usefully applied to illuminating purposes, many attempts have been made by experiment to divest the gas of its several impurities, more especially those arising from the presence of sulphur. Mr Hills ascertained that this purification could be effected by the use of iron rust, and obtained a patent for the use of that substance to such purpose, by its introduction into the presence of the gas after its production, the effect of which is that the sulphur contained in the gas, and by which it is deteriorated becomes absorbed by the rust, and is so purified, and after the rust has sufficiently performed its office it is itself removed for purification from sulphur by the application of atmospheric air, and rendered fit to be again and again employed for the purpose of absorbing the sulphur from gas as it is produced. So that Mr Hills did not obtain a patent for the discovery that iron rust will have this effect, but that, having such a property, he has applied it practically to that purpose, and further that this purifying matter can itself be purified by atmospheric air, and so rendered fit for future use. Mr Evans, not satisfied with the production of iron rust by the most obvious and simple means, to create it has applied gases and divers liquids to filings and small pieces of iron, and when iron rust is so produced used it to the purification of gas by its being passed through a series of purifiers, by which the gas is divested of the impurities caused by the presence of sulphur, and then has in turn purified the rust from sulphur by the application of atmospheric air, after it has been submitted to another series of purifiers. Mr Evans, in effect, says that his application of iron rust so produced to the purification of gas, and after use being itself purified by air, is not an infringement of Mr Hills' patent The remaining important dispute between the parties is whether Mr Hills is entitled to have the injunction granted by the Vice-Chancellor made perpetual at once, considering the amount of litigation that has passed during the last ten years, in which the validity of his patent has been in contest and established, or whether the condition of the affirmance of the Vice Chancellor's judgment must not depend upon the establishment by Mr Hills of the validity of his patent by a new action at law.

The arguments in this case lasted several days, and at their conclusion their Lordships reserved judgment.

Asphaltum Oil: Austen v. The Asphaltum Company (Limited).—This was an action to recover damages for an alleged breach of agreement, and was tried at Guildhall before Mr Justice Keating. The company was established under the Limited Liability Act for the purpose of working in Cuba for a substance called asphaltum, and manufacturing oil therefrom. The company had established works at Poplar, and found that, in the course of the manufacture, there remained in the asphaltum after the oil was extracted, a certain quantity of tar. The company had been in the habit of selling this tar at a penny per gallon. The plaintiff proposed a process by which it would be turned to a better account, by extracting a larger quantity of oil and selling the residue. His estimate was that, out of 600 gallons of tar, costing £35 18s, he could extract 260 gallons of oil, and 1 ton of residuum; the former to sell at 2s 6d a gallon, making £32 10s; the residue at £20 the ton, making £52 10s, and leaving thus a profit of £16 12s. The company entertained his project, and entered into an agreement with him for the purpose of carrying it out, and it was for a breach of that agreement on their part the present action was brought. Mr Hawkins and Mr Joyce appeared for the plaintiff; Mr Kemplay and Mr Turner (with them Mr M. Smith) for the defendants. Before Mr Hawkins had proceeded far in his opening than the statement of the above facts, he was interrupted by the intimation that the junior counsel on both sides had settled the case, and thereupon a verdict was taken by consent for £75.

Chenille: Davenport v. Rickard.—This action was tried at the sittings at *nisi prius* at Guildhall, before Mr Justice Hill and a special jury. The action was brought to recover damages for the infringement of a patent for the manufacture of chenille. At the close of the plaintiff's case objections were made to the specification, and it was arranged that the plaintiff should be nonsuited, subject to the opinion of the Court above. Mr Bovill, Q.C., Mr Serjeant Hayes, and Mr Webster were counsel for the plaintiff; and the Attorney-General, Mr Hindmarch, and Mr Aston for the defendant.

REVIEWS OF NEW BOOKS.

Iron — its History, Properties, and Processes of Manufacture. By William Fairbairn, C.E., &c., &c. Edinburgh: A. & C. Black. 1861. Pp. 235.

The greater part of this little work has appeared in the eighth edition of the Encyclopædia Britannica, and the article has now been reprinted in a handy form, with considerable additions. We have here a sketch of the history of the use of the metal, then an account of the ores from which it is obtained, of the fuel by which those ores are reduced, and of the processes of reduction, followed by chapters on the conversion of crude into malleable iron, and the processes of forging. Mr Bessemer's process has a chapter to itself, and then come chapters on the production of steel, on the strength and other mechanical properties of cast and wrought iron and steel, the chemical properties of iron, the statistics of the iron trade, and on armour plated vessels, a topic which is just now of considerable interest. The appliances of iron have not been treated of, as this was a subject of such magnitude as to require a separate treatise. We agree with the author in thinking that in the manufacture of iron much has yet to be done; and that we may reasonably look forward to great improvements in the various processes of reduction, conversion, rolling, forging, &c., based upon scientific principles derived from more extended chemical researches. The volume is well illustrated with wood-cuts, and is a welcome addition to the literature of the subject. For the student's use nothing can be found more suitable.

The Practice of Hand-Turning in Wood, Ivory, Shell, &c.; with Instructions for Turning such works in Metal, as may be required in the practice of Turning in Wood, Ivory, &c. Also, an Appendix on Ornamental Turning By Francis Campin. London: E. & F. N. Spon. 1861. Pp. 304.

The beginner will find this a very useful instructor in the art of turning. In addition to information on the various operations themselves, there are chapters on the tools employed, on the means of staining and polishing, and on the materials commonly used in the art. There is an appendix on ornamental turning. Amongst other pieces of information, the work contains an explanation of the way in which those puzzling Chinese balls are made, as well as the mode of making elegant little vases out of egg shells, a process by which such a delicate material as a sparrow's egg can be operated upon.

Look to your Provisional Specifications—A Word of Caution to Patentees and Inventors. Second Edition. By William Spence. London: Weale. 1861. Pp. 31.

This is the second edition of a pamphlet which points out the necessity of being careful in the preparation of a Provisional Specification. Some intending patentees suppose that as the document is only provisional, almost anything will serve the purpose, and they disregard the words of the statute which require that the document should *describe the nature of the invention, and in what manner the same is to be performed.* They ought, however, to bear in mind that if the Provisional Specification is insufficient, if it does not comply with the directions of the statute, the patent itself will be valueless. As a specimen of the pamphlet, we reprint the following sensible remarks:—

"It appears essential for patentees to look to their Provisional Specifications; on the one hand, in order to comprehend therein the inventions detailed and claimed in their final specifications; and, on the other hand, in order to avoid encumbering them with points that would be more properly reserved for the final specifications. And experience shows that good advice is needed, in order to determine both what matters ought to be stated in Provisional Specifications, and what matters omitted. Now, when I add to this the remark that probably some judicious advice may be required on the question of novelty (for although the Patent Commissioners supply materials for forming a judgment on this point, they cannot supply trained faculties for the right use of them), it will at once be understood that there is much need for discrimination in the choice of an agent, on the part of every applicant for a patent. And this brings me to allude with regret to the notorious fact, that there are agents thrusting their names before the public, who cannot pretend to give any reasonable evidence of their possessing the requisite qualifications for practice. Dr Herbert Davies, in an introductory address delivered in 1852, to the students of the London Hospital school of medicine, says: "I need not ask what would be your opinion of a man who should rashly and daringly attempt an operation on a portion of the human body, with which he was only partially and superficially acquainted, and when the slightest error in the direction of his scalpel would bring inevitable death upon the poor sufferer, who has placed all his earthly hopes upon the presumed skill and information of the operator?" Now, every one must admire this manly appeal to the better part of human nature in a professional man. But I will ask,—what would be your opinion of the prudence of a man requiring good surgical help, or good medical advice and treatment, calling in the aid of a surgeon or physician whose name was known to him only in the columns of a newspaper or class periodical? I leave patentees and inventors to make their own application of this query."

CORRESPONDENCE.

THE ROTATION OF BODIES ON THEIR AXES.

The crank shaft of a steam engine, grindstone, or any other machine, cannot represent the moon's motion "on her own axis," neither is it an illustration applicable to the subject. The fact is, a shaft, crank, and pin, are not necessarily three separate bodies, although, for convenience, they are so made, but one and the same body, as they may be cut out of the solid, and are so made for locomotive engines, and cannot therefore represent in any way the action of two independent bodies rotating on their own axes, but only one.

What is a crank shaft, and its so-called crank pin? Nothing more than the axis of a shaft diverted from the straight line.

Fig 1

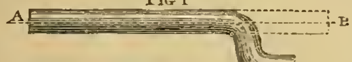


Fig. 2

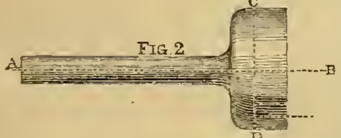


Fig 3

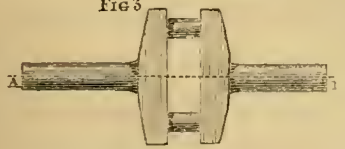


Fig 4

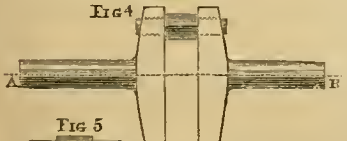


Fig 5

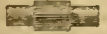


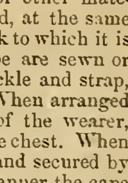
Fig. 1 will prove to any one that the bending of the shaft does not separate the body; it still remains but one, and the whole turning still upon the one axis, A, B, therefore, there cannot be an independent mechanical axial motion in that part called the pin—in practice, bending the axis prevents increasing the size of the shaft. Take another illustration, fig. 2; this again is a shaft with a half-circular mass at the end. No one will doubt but that this mass, with its elongated part, rotates upon the axis, A, B, and no alteration of its shape can alter this *fact*, or produce any other mechanical axis of motion. Now, suppose the mass to be cut away on its face to the dotted line, C, D, only leaving a round pin at its lowest edge, which will now represent a crank pin. Will any one assert that any new mechanical axis of motion is created by so doing? Take the illustration, fig. 3; this again is one body equally capable of being cut out of the solid, turning upon *one* axis of motion, A, B. No one will assert that by the mere cutting away of one of the connecting branches a new mechanical axis will be produced; therefore, the mass turns still upon the same axis, A, B.

In reference to the idea that a crank pin bearing must be round, on the supposition that a crank pin rotates upon its own axis, is not the case, the fact being totally otherwise. It is because it does not rotate upon its own axis that it is actually necessary to make it round, so that the bearing of the connecting rod may go round (as it may be truly said) without it, as it cannot go round itself.

I assert, on the contrary, that if the crank pin had axial motion, that a *square* or *triangular* bearing would equally answer the purpose. In proof of which, take the same illustration, fig. 4, which we have proved above to be but one body rotating upon one axis of motion; cut away the remaining connecting part, which represents a crank pin, and bore holes through the side blocks in its place, now draw the two halves of the shaft apart, insert the pin, fig. 5, with its square bearing in the centre, we now create a second mechanical axis of motion; and, in this case, a square or triangular bearing will answer the same purpose, and the hand may be used, without harm or damage, to turn the whole shaft. Why? Because there are now two independent axes of motion; whereas, in the common *crank* shaft there is but one.

This also disproves the idea that the crank pin in its common form has axial rotation, and at the same time proves that this movement, when axial motion is given to the crank pin, only amounts to a vibration upon its own axis, and not a complete rotation.

Fig. 6.



Give the crank pin the power of motion on its own axis, and the bearing at that end of the connecting rod may be dispensed with in a direct acting steam engine. The connecting rod may now be fixed, as in fig. 6, the *crank pin vibrating, but not rotating*, upon its own axis. This, I think, is sufficient to set at rest the idea that the common *crank* shaft in any way illustrates the moon's motion "on her own axis."

The axis here confounded with the moon's axis is the axis of her orbit, or the axis of the earth, and not the axis of the moon.

Cheltenham, July, 1861. BERTRAM MITFORD.

REGISTERED DESIGNS.

KNAPSACK OR PACK CAPE.

Provisionally Registered for MR H. ASTLEY HARDING, 3 *Grange Loan, Edinburgh.*

An exceedingly useful addition to the accoutrements of the soldier or volunteer has been devised by Mr H. A. Harding, in the shape of a cape, which is attached to the knapsack or pack. The garment, when not in use, forms a small neat roll at each end of the knapsack, with the utility of which it does not in any way interfere. When unrolled, the cape is adapted for protecting the wearer during wet or cold weather. The cape is, at the same time, by its combination with the knapsack or pack, made so portable that it forms a very trifling addition either to the weight or bulk of the article.

Fig. 1.

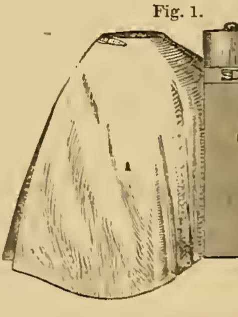


Fig. 2.

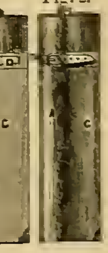


Fig. 1, of the subjoined engravings represents the cape attached to a knapsack, and opened out for wear. Fig. 2, is an end view of the knapsack, showing the cape rolled up. The cloth, or other material, A, for the cape, is cut out to the figure of a cape, and, at the same time, to admit of its being attached to the knapsack or pack to which it is to be adapted. The edges of the recessed part in the cape are sewn or otherwise attached to the knapsack or pack, C, and a buckle and strap, or other fastening, D, is fitted to the front of the neck. When arranged in this way, the cape covers the upper part of the body of the wearer, extending below the elbows, and completely protecting the chest. When not required for use, the sides of the cape are rolled up and secured by means of buckles and straps, as shown at D. In this manner the cape is carried without in any way lessening the utility of the knapsack or pack, and may be instantly made available to protect the wearer without disarranging the supporting straps, E, or otherwise interfering with it.

STEAM HAMMER.

By Mr Robert Morrison, *of Ouseburn Engine Works, Engineer.*

(Illustrated by Plate 277.)

The Plate which accompanies the present number of our *Journal* is a striking illustration of the gigantic tools which the requirements of modern engineering are daily calling into use. Not long since, Mr Morrison's firm constructed a ten tons hammer, with an eight feet stroke, for the Elswick Ordnance Works, and now these gentlemen have gone far beyond this, by building for their own use a fifteen tons hammer, of which machine the accompanying plate is an illustration. Fig. 1 is a front elevation, and fig. 2 an end view of the hammer in complete working order. The massive A-shaped frame of the hammer is bolted down to a suitable sole plate, arranged on an extended substructure of masonry. The hammer block, or anvil, which is arranged midway in the arch or opening of the main frame, does not rise much above the level of the ground. The cylinder is bolted to the main frame. Its heavy piston bar, which forms a peculiar feature in Mr Morrison's Steam Hammers, works out through the lower end cover of the cylinder. The piston bar is widened out laterally at the extremity, forming the hammer head, which is fitted with a dovetailed steel face in the usual manner. The steam pipe and exhaust are carried inside the main hollow frame, as are also the other mechanical details. In this way all that is seen externally are the hand levers for starting and controlling the movements of the hammer. In the general arrangement of this hammer there is, if we may so express ourselves, a classical severity or simplicity of style, when we regard the machine as a whole, that harmonizes well with its immense proportions, and the Herculean character of the work it is designed to perform. The outlines of the frame form graceful sweeps or curves, that are particularly pleasing to the eye. The machine is altogether an excellent example of what is doing at the present moment in this branch of industrial manufactures.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

THE ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS.

June 25, 1861.

At the last ordinary monthly meeting of this association, Mr L. E. Fletcher, chief engineer, presented his monthly report, from which we extract the following:—

"During the past month 208 visits have been made, 559 boilers as well as 461 engines have been examined, and the following defects discovered: Fracture, 7; corrosion, 13 (1 dangerous); safety valves out of order, 11; water-gauges ditto, 13 (2 dangerous); pressure-gauges ditto, 13; feed apparatus ditto, 4; blow-off cocks ditto, 9; fusible plugs ditto, 4; furnaces out of shape, 11; over-pressure, 1; deficiency of water, 3; boilers without safety valves, 3 (dangerous); total, 89 (6 dangerous); boilers without glass water-gauges, 4; without blow-off cocks, 26; without pressure-gauges, 4; without feed-back pressure valves, 63. There is a description of feed-stop valve, which I find in very general use, the inconvenience and even danger attending which, I think, our members are not sufficiently aware of; and I wish to call their attention to this, that its use may be discontinued where new boilers are being erected, and the construction of existing ones corrected as far as possible. The valve to which I refer is constructed on the suspension principle; it being opened against the force of the feed by a spindle attached to it, so that, should the connection between them at any time fail, the valve drops to its seat, and cuts off the feed. I have found very few cases in which this valve has been in use for any length of time where this connection has not given way unawares, always causing more or less inconvenience—in some cases the stoppage of the works, and in one case explosion and loss of life. The remedy is simple and inexpensive. Dispense with the feed-stop valve proper altogether, and regulate the supply by controlling the lift of the back-pressure valve by a screwed spindle placed above it, but entirely disconnected from it. This arrangement makes one valve answer the double purpose; it is simpler and less expensive than that of having two distinct valves—is in very general adoption, and found to work well; and I shall be glad to see it entirely supersede the other arrangement. Although this is but a minor detail, still I attach importance to it, from the fact of loss of life having occurred from its malconstruction

"I wish our members would avail themselves more regularly than they do of the opportunity afforded by this association, of having each of their boilers internally and "thoroughly" examined once a year. No external examination, however carefully made, can render this unnecessary, and I must therefore beg the co-operation of members in this respect. The ravages of corrosion are so silent and stealthy, that many boilers, supposed to be by their owners in a most healthy condition, are found, upon "thorough" inspection, to be so eaten away in places, that a blow with a hammer penetrates them; and seldom a month passes but I meet with cases of this kind. This although not exclusively so, is most frequently met with in boilers set upon mid-feathers.

"Nothing could corroborate the above remarks more strongly than an explosion which has occurred since they were written, to a boiler not under the inspection of this association, and which has resulted in serious injury to two men, one of whom has since died in consequence. I examined the fragments, and found that the explosion had been caused entirely by external corrosion, the plates being thereby reduced from $\frac{3}{8}$ to less than $\frac{1}{8}$ of an inch in thickness. This did not manifest itself internally, but would have been detected, had a thorough examination been made of the surfaces of the plates in the external flues. Both the superintending engineer to the works, as well as the men more immediately in charge of the boiler, were taken quite by surprise at the state in which the plates proved to be, as well as at the devastation caused by steam at so low a pressure as twenty-five pounds. I trust, therefore, that the members of this association will not rely upon low pressure or internal examinations alone, but make arrangements for having their boilers "thoroughly" inspected, both internally and externally."

INSTITUTION OF CIVIL ENGINEERS.

Session, 1860-61.

The Council of the Institution of Civil Engineers have awarded the following Premiums:—

A Telford medal, and a Council premium of books, to William Henry Preece, Assoc. Inst. C.E., for his paper "On the maintenance and durability of submarine cables in shallow waters."

A Telford medal, and the Manby premium, in books, to George Parker Bidder, Junior, for his paper "On the national defences."

A Telford medal, to Francis Fox, M. Inst. C.E., for his paper "On the results of trials of varieties of iron permanent way."

A Council premium of books, to Frederick Braithwaite, M. Inst. C.E., for his paper "On the rise and fall of the river Wandle; its springs, tributaries, and pollution."

A Council premium of books, to George Hurwood, M. Inst. C.E., for his paper "On the river Orwell and the port of Ipswich."

A Council premium of books, to William Hall, Assoc. Inst. C.E., for his paper "On the floating railway at the Forth and Tay ferries."

The Council invite communications on the following, as well as other subjects, for premiums:—

On the principles upon which the works for the improvement of river navigation should be conducted.

On the effect of engineering works in causing injurious scour, flooding, or silting-up, in tidal estuaries or rivers.

On the effect of sluicing, in removing and preventing deposits, at the entrance of docks on the coast and in tidal rivers.

On reclaiming land from seas and estuaries.

On the results of the employment of steam power on canals, and of other measures for the improvement of canals as a means of conveyance for heavy traffic.

On the method of constructing foundations, for large structures, in deep water; and on the various systems of driving piles.

Description of cast, or wrought, iron cranes, scaffolding and machinery, employed in large works, in stone quarries, as hoists, or lifts on quays, in warehouses, etc., especially where either steam or water is used as a motive power.

The selection of sites for the construction of docks on the course of tidal streams, with reference to communication with railways, and with inland navigation.

The selection of sites for, and the principles of the construction of, breakwaters, harbours of refuge, piers, moles, sea walls, and shore defences.

On the arrangement and construction of floating landing-stages, for passenger and other traffic.

The construction of lighthouses, their machinery and lighting apparatus.

On the mechanical methods of boring and of sinking large shafts, of introducing the tubbing and the impervious lining, and of traversing running sand and other difficult strata.

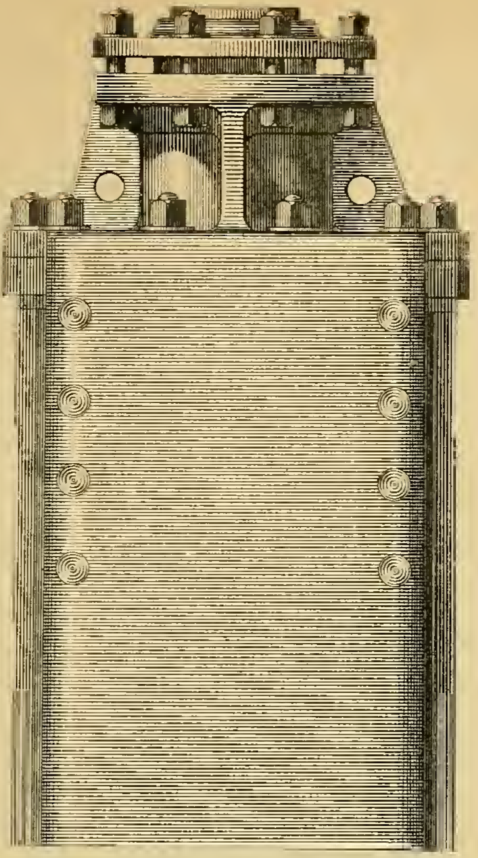
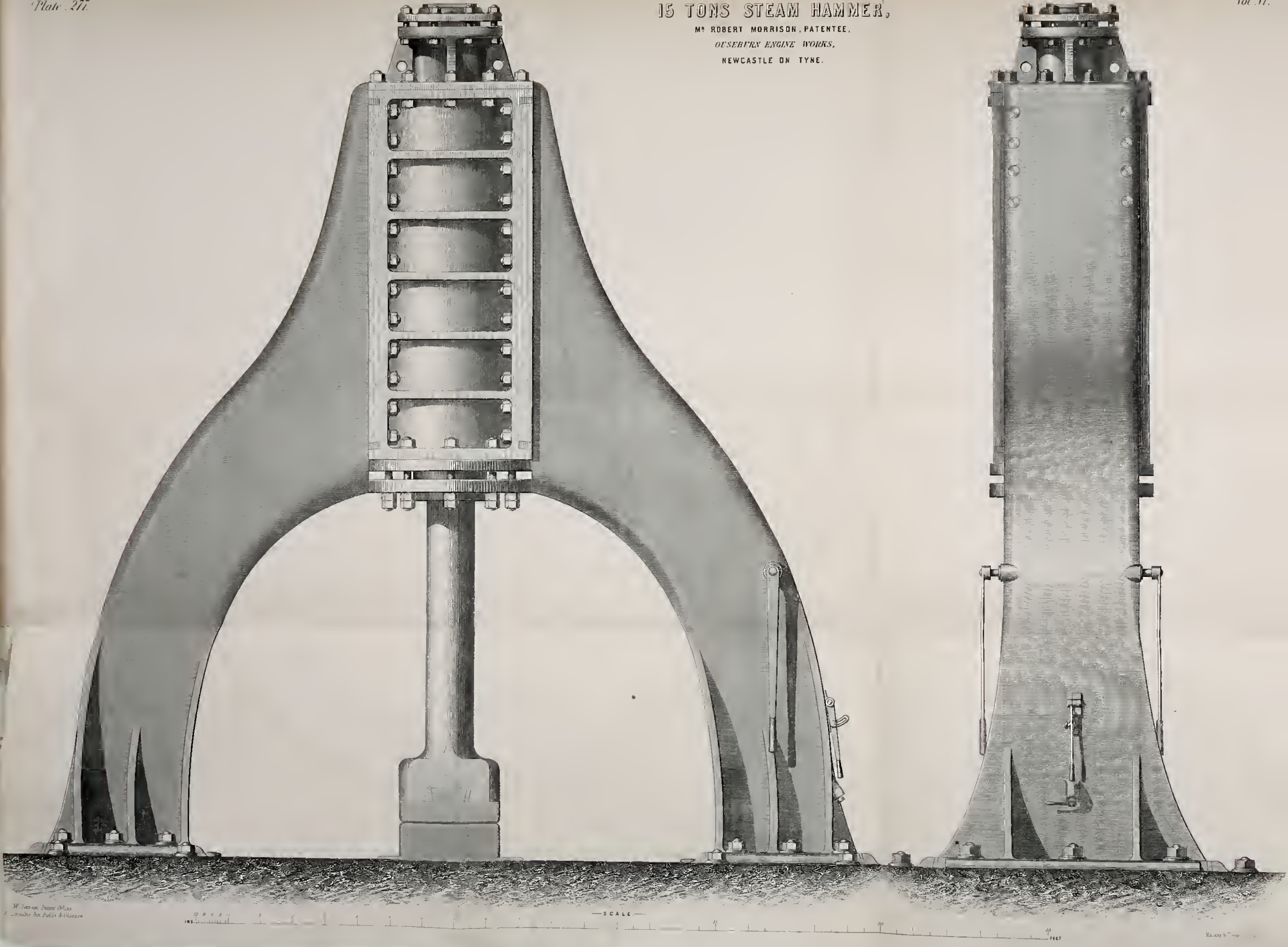


Plate. 277.

15 TONS STEAM HAMMER,

MR ROBERT MORRISON, PATENTEE,
OUSEBURN ENGINE WORKS,
NEWCASTLE ON TYNE.



W. Johnson, Patent Offices
Lincolns Inn Fields & Glasgow

The results of contrivances for facilitating the driving of tunnels, or drifts in rock.

Accounts of the various modes adopted for moving earth in tunnels, cuttings or embankments, with the cost.

On the different systems of swing, lifting, and other opening bridges, with existing examples.

On the construction of suspension bridges, with rigid platforms, and the modes of anchoring the stay-chains.

The results of a series of observations on the flow of water from the ground, in any large district; with accurately-recorded rain-gauge registries, in the same locality, for a period of not less than twelve months.

On the construction of catch-water reservoirs in mountain districts, for the supply of towns, or for manufacturing purposes.

Accounts of existing water-works; showing the methods of supply, the distribution throughout the streets of towns, and the general practical results.

The comparative duty performed by, and improvements in the construction of, modern pumping engines for raising water, for the supply of towns, or for the drainage of mines.

The results of the use of bucket and rotary pumps, for lifting large quantities of water to a limited height, as at the Haarlem Meer, or at Whittlesea Mere, or for the purposes of irrigation.

The drainage and sewerage of large towns; exemplified by accounts of the systems at present pursued, with regard to the level and position of the outfall, the form, dimensions, and material of the sewers, the prevention of emanations from them, the arrangements for connecting the house drains with the public sewers, and the disposal of the sewage, whether in a liquid form, as irrigation, or in a solid form after deodorisation.

On the means of rendering large supplies of water available for the purpose of extinguishing fires, and the best application of power to the working of fire engines.

On boiler inspection, as practised in this country and on the continent.

On the causes of the alleged failure in economising fuel in working steam expansively, and the probable conditions for insuring success.

On the results of the use of superheated steam, and of surface condensation.

On substitutes for steam, and the causes of their failure.

On the results of the use of tubular boilers, and of steam at an increased pressure, for marine engines, noticing particularly the difference in weight and in speed, in proportion to the horse power and the tonnage.

On the measure of resistance to steam vessels at high velocities.

The substitution of machinery for manual labour, for raising, lowering, and reefing the sails, weighing the anchor, &c., on board ship.

On steam vessels of light draught for the shallow rivers of India, &c.

On the form and materials for floating batteries and iron-plated ships.

On the construction of rifled and breech-loading artillery; and on the initial velocity, range, and penetration of rifled projectiles, and the influence of atmospheric resistance.

Description of street railways and carriages, as used in the United States of America, in Paris, and elsewhere, with the results.

Improvements in the construction of railway carriages and waggons, with a view to the reduction of the gross weight of passengers and goods trains; also of railway wheels, axles, bearings, axle-boxes, and breaks, and of bearing, traction, and buffer springs.

Descriptions of the various kinds of machinery in use in the principal shipping ports, for the shipment of coal.

On the means of utilizing the products of the distillation of coal, so as to make coke commercially as cheap as coal.

The precautions to be adopted for guarding against accidents by fire-damp and after-damp in mines.

The chemical analysis, and the application to economic purposes, of the gases generated in iron blast furnaces.

Description of modifications of the present systems of smelting iron ores, of improvements in the conversion of cast-iron into the malleable state, and of the manufacture of iron generally.

The process of manufacture, and mode of treatment, of aluminium.

On the mechanism of astronomical instruments.

On machinery adapted for the better separation of the various substances found in combination with metallic productions.

On the substitution of machinery for manual labour in mining operations; and on hydraulic machinery in mines.

On the improvements which may be effected in the buildings, machinery, and apparatus for producing sugar from the cane in the plantations and sugar-works of the British colonies, and the comparison with beet-root, with regard to quantity, quality, and economy of manufacture.

Accounts of improvements in flax and cotton machinery, and in the processes for preparing those substances for manipulation.

An account of the mechanical means at present in use for facilitating the operation of packing materials and goods, whether by hydraulic power or otherwise.

The uses of vulcanized or mineralized caoutchouc; the means of increasing its durability, and the modes of causing its adhesion to metal.

On the application of photography to engineering.

On the application of the electric telegraph to railway train signalling.

MONTHLY NOTES.

MARINE MEMORANDA.

H.M.S. Howe.—At the second contractors' trial of the engines of the screw steamship *Howe*, 121, outside Plymouth breakwater, a mean speed of 13·569 knots was obtained. This rate is said to be unexampled, and exceeds by nearly half a knot—4 10ths—that obtained from the sister ship *Victoria*, 121, at Portsmouth. On the first trial the weather was rather boisterous. The trunk engines of the *Howe* are of 1,900 horse-power nominal. The four boilers are tubular; furnaces, 32; pressure of steam on boilers, 20lb; mean pressure on the piston, 24lb. Maudslay's shifting propeller was used; diameter of screw, 20 feet; pitch, 28 feet; mean revolutions, 57½; *maximum*, 58. The *Howe* is not yet supplied with masts or guns; her draught forward is 20 feet 6 inches; aft, 22 feet 9 inches.

Testing Anchors and Chains.—The Tynemouth Chamber of Commerce has opened a public test for anchors and cables on the Tyne, and there is little doubt but that it will be generally adopted by the insurance clubs, as a number of the more active members of their committee are directors of the Chamber. It was stated at a recent meeting of the Chamber that by a rule recently adopted by Lloyds, a vessel insured there was allowed to carry a less quantity of tested chain in her outfit, so that if the tested chain cost more per cwt. the real outfit of the vessel cost less than if she carried chain cable not publicly tested. It is stated that however honestly a chain cable may be made, no confidence can be placed in it until it is subjected to the *maximum* test, as the least flaw in the heating of the iron, or in its weld, may make it an utterly worthless production for purposes of safety.

Steam Shipbuilding on the Clyde.—Messrs Allan Brothers, by advice of Mr Wallace, their engineer superintendent, have decided on introducing Mr Spencer's system for securing surface condensation into two new mail ships of 2,500 tons and 400 horse-power, contracted for by Messrs Denny, of Dumharton, for the Canadian line; and two other ocean steamers are also to be fitted with similar arrangements for the same company. One of these ships is building by Messrs Barclay and Curle, of Glasgow, and the other by the Greenock Foundry Company and Mr Steel, of Greenock. The *Arratoon Apcar*, a screw of 1,500 tons register, has been launched by Henderson and Son, of Renfrew. She has been built for Messrs Apcar and Co., an old established Calcutta firm, and is intended for the Indian trade. Messrs Henderson will supply the steamer with patent diagonal oscillating engines of 250 horse-power nominal. The ship has derived her (to English eyes) rather singular name from the senior member of her owners' firm. The *Sidon* and *Morocco*, two fine screws of 1,785 tons burden and 250 horse-power each, are now being built for the Cunard Company by Messrs W. Denny and Brothers, and will be engined by Messrs Tulloch and Denny. The *China*, another screw, of 2,550 tons burden and 550 horse-power, is also being built for the same owners by Messrs R. Napier and Sons, and will be engined by the same firm.

At Newcastle-on-Tyne, the manufacture of machinery of all kinds in the large works, and iron shipbuilding upon the Tyne and Wear keep extremely active. Messrs Richardson, Messrs Palmer Brothers, Messrs T. and W. Smith, Mr Leslie, and other firms on the Tyne, are engaged executing orders for iron screw vessels and sailing ships. Messrs C. Mitchell and Co., of Low Walker, have on hand a considerable number of vessels for river purposes for almost every part of the world. They are at present building two iron paddle steamers, each of the following dimensions:—Length 120 feet; breadth, 21 feet; depth 7½ feet. These steamers, which will be fitted up with oscillating cylinders, and engines of 60 horse-power, are intended for the Russian Government, and will be employed in towing, &c., at the dock yard at Cronstadt. The same firm are also building for the same Government an iron screw despatch tender of the following dimensions:—Length, 60 feet; breadth, 11 feet; depth, 5½ feet. The engines will be of 70 horse-power. The tender is already so far advanced as to be ready to take her machinery. Messrs Mitchell and Co. have also in hand a first-class iron paddle-steamer for the Hunter River New Steam Navigation Company at Sydney, of the following dimensions:—Length 220 ft.; breadth, 25½ ft.; depth, 13 ft. The steamer will be fitted with oscillating cylinders, and engines of 200 horse-power, by Messrs R. Morrison and Co., of the Ousehurn Engine Works. The steamer, which is expected to attain a speed of 15 knots an hour, is being built under the inspection of Mr John Dudgeon, of London, and will be employed in conveying passengers and goods. There is also building by Messrs Mitchell and Co. an iron screw steamer, to be fitted with Wealleu's patent machinery, consisting of high pressure and condensing cylinders, with surface condenser, the whole of which will be manufactured by Messrs R Stephenson and Co., Newcastle. The engines will be of 70 horse-power, and the following are the dimensions of the steamer:—Length, 165 ft.; breadth, 26 ft.; depth, 17 ft. Mr William Pile, of Sunderland, has recently launched the first iron vessel built by him from his building-yard on the North Sands. She is a screw steamer of 830 tons o.m., and is built for Mr Young of Wisbeach, to be employed in the Baltic trade. Mr Pile has two other iron vessels in hand; a screw steamer of 700 tons, and a sailing vessel of 1,020 tons. The same builder is also preparing to lay down two other iron vessels of 500 tons each.

The Mooltan Steamer.—On the official trial of this vessel, the last new addition to the Peninsular and Oriental Company's fleet, she left her moorings at 11 30 a.m. drawing 18 ft. 10 in. water forward, and 19 ft. 2 in. aft., and proceeded down the Southampton Water and through the Needles passage to about four miles beyond the Needles, when she turned round, and arrived in the docks at 4 5 p. m., thus running a distance of 56 nautical miles in 4 hours 35 minutes, or at the rate of 12 1-3rd nautical miles per hour, the tide being favourable for one hour only. Taking into consideration the small proportion of horse-power to tonnage, this result was considered satisfactory. The *Mooltan* is 2400 tons burden, and 400 horse-power, 370 feet long, 31 feet deep, and 39 feet wide. Owing to there being a stiff breeze blowing, the *maximum* speed at the measured mile was not taken on this occasion. The machinery worked admirably, realising an indicated power of 1600 horses, or four times the nominal power. Revolutions of screw 54 to 56 per minute; vacuum in the condensers (surface-condensers on Hall's principle) 26½ to 2 inches. The consumption of fuel during the trip was rather less than 2lb. per indicated horse power per hour. The *Mooltan* is now fitted with a three-bladed fixed screw, 24 ft. 3 in. pitch, and 16 feet diameter. Her engines are super-heating, on Mr A. Lamb's patented principle. All the latest improvements in machinery, &c., are introduced into this noble vessel, including a number of useful and ingenious inventions. The cooking apparatus for the saloon passengers and officers, fitted up by Benham and Son, of London, is very complete and compact. It includes five ovens, a large hot-water and steam boiler, a spacious hotplate, steam-kettles, &c., affording accommodation for cooking dinners for 200 or 300 persons, including the pastry and the confectionery, as well as for baking bread, while the temperature of the galley is hardly above that of a kitchen ashore.

The *Great Eastern* reached Liverpool on her return voyage on the 4th of June, bringing 212 passengers, 3000 tons of flour, grain, and provisions, and also 1000 tons of water ballast. On leaving New York her draught of water was 26 feet. She sailed from New York on Saturday, the 25th ult., at half-past 8 o'clock in the morning, and arrived off the bar at the Mersey on Monday evening about half-past 9 o'clock, having accomplished a most successful voyage. During the voyage the *Great Eastern* behaved exceedingly well, being perfectly manageable under all circumstances of weather. The highest speed attained was 355 knots in the 24 hours, the screw seems the chief propelling power employed. The nature and rate of the voyage, however, will be better understood from the following extracts from her official log:—May 25.—Course, N. 88 E.; wind, S.S.E.; barometer, 29 70; thermometer, 65. At 8 19 pilot left the ship; light breeze. May 26.—Distance run, 337 miles; wind various; lat. 40 40, long. 66 07; barometer, 29 66; thermometer, 70; consumption of fuel, 289 tons 13 cwt.; light airs. May 27.—Course, N. 83 E.; distance run, 300 miles; wind, S.E.; lat. 41 28, long. 59 52; barometer, 29 74; thermometer, 67; consumption of fuel, 291 tons; thick weather; standing by engines. May 28.—Course, N. 73 E.; distance run, 340 miles; wind, S.S.E.; lat. 43 07, long. 52 25; thermometer, 61; consumption of fuel, 295 tons 2 cwt. Fresh breeze and thick weather; stopped engines 15 minutes to sound at 10 p.m.; going slow for 45 minutes. May 29.—Course, N. 67 E.; distance run, 320 miles; wind, S.S.W.; lat. 45 01; long 45 28; barometer, 29 80; thermometer, 58; consumption of fuel, 287 tons 7 cwt. Fresh breeze and fine weather. May 30.—Course, N. 71 E.; distance run, 350 miles; wind, N.W.; lat. 47 04; long. 7 33; barometer, 30 02; thermometer, 58; consumption of fuel, 301 tons 1 cwt. Fresh gale and gloomy weather. May 31.—Course, N. 79 E.; distance run 318 miles; wind, W N.W.; lat. 48 14, long. 29 09; barometer, 29 39; thermometer, 65; consumption of fuel, 300 tons 12 cwt. Light breeze and fine. June 1.—Course, N. 75 E.; distance run, 355 miles; wind, N.E.; lat. 49 30, long. 21 11; barometer, 30 41; thermometer, 62; consumption of fuel, 301 tons 15 cwt. Light breeze and fine. June 2.—Course, N. 79 E.; distance run, 325 miles; wind, N.N.E.; lat. 50 28; long. 12 55; barometer, 30 35; thermometer, 62; consumption of fuel 288 tons. Fresh breeze. June 3.—Barometer, 30 20; thermometer, 59; consumption of fuel, 293 tons 9 cwt. Fresh breeze; at 9 30 p.m. anchored.

The Cunard Line.—The fine fleet known as the Cunard line now comprises the following steamers:—The America, paddle, 1826 tons burden and 650 horse-power, built in 1848; the Niagara, paddle, 1825 tons burden and 650 horse-power, built in 1848; the Europa, paddle, 1918 tons burden and 800 horse-power, built in 1818; the Canada, paddle, 1831 tons burden and 670 horse-power, built in 1848; the Satellite, tender, paddle, 157 tons burden and 80 horse-power, built in 1848; the British Queen, screw, 763 tons burden and 150 horse-power, built in 1849; the Asia, paddle, 2227 tons burden and 750 horse-power, built in 1850; the Africa, paddle, 2226 tons burden and 750 horse-power, built in 1850; the Arabia, paddle, 2393 tons burden and 830 horse-power, built in 1852; the Balbec, screw, 830 tons burden and 150 horse-power, built in 1853; the Melita, screw, 1255 tons burden and 180 horse-power, built in 1853; the Karnak, screw, 1127 tons burden and 100 horse power, built in 1853; the Jackal, tender, paddle, 180 tons burden and 100 horse-power, built in 1853; the Jura, screw, 2241 tons burden and 440 horse-power, built in 1854; the Stag, paddle, 499 tons burden and 240 horse-power, built in 1854; the Lynx, paddle, 499 tons burden and 240 horse-power, built in 1854; the Persia, paddle, 3300 tons burden and 900 horse-power, built in 1856; the Stromboli, screw, 734 tons burden and 100 horse-power, built in 1856; the Australasian, screw, 2761 tons burden and 700 horse-power, built in 1857; the Leopard, paddle, 691 tons burden and 320 horse-power, built in 1858; the Palestine, screw, 1377 tons burden and 260 horse-power, built in 1858; the Olympus, screw, 1794 tons burden and 250 horse-power, built in 1860; the Marathon, screw, 1784 tons burden and 250 horse-power, built in 1860; the Hecla, screw, 1715 tons burden and 250 horse-power, built in 1860; the Atlas, screw, 1794 tons burden and 250 horse-power, built in 1860; the Heron, screw, 624 tons burden and 150 horse-power, built in 1860; the Ostrich, screw, 624 tons burden and 150 horse-power, built in 1860; the Giraffe, paddle, 677 tons burden and 290 horse-power, built in 1860; the Kedar, screw, 1783 tons burden and 250 horse-power, built in 1860; and the Scotia, paddle, 4000 tons burden and 1000 horse-power, built in the present year. Besides these 30 steamers, there are three large vessels building, viz.—the Sidon, screw, 1785 tons burden and 250 horse power; the Morocco, screw, 1785 tons burden and 250 horse-power; and the China, screw, 2550 tons burden and 550 horse-power. All the steamers mentioned above are built of iron, with the exception of the America, Niagara, Europa, Canada, Asia, Africa, and Arabia. They were all built and engined by Clyde firms.

Emigration.—During the year 1860, 83,774 emigrants sailed from Liverpool, 11,798 from London, 4,315 from Plymouth, 2,187 from Southampton, 777 from Bristol, and 150 from other English ports; 2,940 from Glasgow, 720 from Greenock, and 212 from other Scotch ports; 12,883 from Cork, 6,117 from Galway, 2,305 from Londonderry, and 291 from other Irish ports.

Antimony Paint.—A patent has been recently obtained for a new paint prepared from antimony, which is of a delicate stone colour, and is considered quite equal in body or opacity to the best white lead, while it possesses the great superiority over it of maintaining its colour in vitiated atmospheres, being free from anything hurtful to the workmen in either its manufacture or use. What is still more important to the consumer, it is said that, weight for weight, it will go about 25 per cent. farther as a paint. These considerations, together with its being offered at a price less than white lead, ought to secure for it the preference, especially where large surfaces have to be covered, such as the interiors of ships, gas works, hospitals, unions, &c. Messrs Hallett & Co., of 52 Broadwall, Blackfriars, are now introducing this paint to the notice of the public.

Customs Returns.—These returns for Newcastle for the month of May of this year, show a somewhat unfavourable state of trade in many of the northern coal ports as compared with May, 1860. In May, 1861, 199,038 tons of coals were exported from Newcastle, as compared with 214,188 tons in May, 1860; Sunderland, 109,373 tons, against 117,822; the Hartlepools, 68,790, against 68,171; Middlesborough, 13,580, against 9047 tons. The following quantities of coals were sent to London and coastwise;—Newcastle, 194,360; Sunderland, 139,970; the Hartlepools, 118,777; Blyth, 13,384; Seaham, 62,304; Middlesborough, 16,615; Maryport, 32,020; Whitehaven, 14,385 tons. Goods, other than coals and coke, show an increase of 96,455*l.* in the value exported from the Hartlepools, 992*l.* from Sunderland, 988*l.* from Middlesborough, and a decrease of 69,185*l.* from Newcastle.

Accidents in Coal Mines.—The annual reports just published by the Government inspectors of mines show an increase of no less than 22 per cent. in the number of lives lost from mining accidents in 1860 as compared with 1859. The quantity of coal raised in 1860 is estimated at 72,000,000 tons; and the proportion of deaths was from explosions from firedamp one to each 198,347 tons raised; from falls in mine one to each 185,567 tons; from accidents in shafts one to each 395,604 tons; from miscellaneous accidents underground one for each 590,164 tons; and from accidents at surface one for each 1,333,333 tons. The average number of lives lost for each million tons of coals raised was 15·5 in 1859, and 15·4 in 1860, the extraction of coal having rather more than kept pace with increased sacrifice of life. It should be added that the number of accidents diminished 5 per cent., but those which did occur were of a more fatal character.

Cotton in Jamaica.—The first pod of Sea Island cotton that has burst from a tree, planted in November last, on the land of the Jamaica Cotton Company, lately arrived in this country. The anxiety of the people to plant, and especially the small settlers, appears to be very great, and they are buying up seed in all directions. The agent of the company states that he has employed about 100 men to clear and burn off land in order to a new plantation; and that he will undertake to get 1000 acres planted without delay, and as to picking it, that there will be no want of hands to get in any quantity that money can be found to plant. He has been paying 1s. per square chain for cutting down the timber and bush and hoeing clean. The Jamaica papers speak with high approbation of the plan, and hope the company will proceed in the work with vigour, as one greatly required for the employment of hands not fit for sugar cultivation.

Galvanography.—M. Jacquemin, of Paris, has lately patented a process for producing drawings in relief on metal which may be thus briefly described. The design is transferred to the metal and the lines protected with a resinous matter, an acid is then employed to remove the metal between the lines. Every one knows how very difficult it is to keep the lines clear and distinct, and the great care which is requisite in the practice of this art. The process adopted by M. Jacquemin is based on an application of electricity. In galvanoplastic operations, the bath must be kept at an uniform temperature, which is effected by restoring, by means of a soluble electrode placed at the positive pole, so much metal as is deposited at the negative pole. The plate to be engraved is substituted for the ordinary soluble electrode, which consists of a simple plate of metal. A metallic deposit takes place at the negative pole, while the positive pole loses a corresponding quantity of metal, which is obtained from the portion of the plate not covered with ink, so that after a while the design appears in relief. One of the applications of the process is said to be the production at a small outlay of the cylinders or other surfaces employed in the printing of textile fabrics.

A New Material for Paper.—The cry abroad, as at home, is evermore, "Paper, paper, more paper!" We learn from the *Revue Horticole de Paris*, that there is likelihood of a large supply from Algeria—not the produce of African rags, but of the maize plant, which can be very profitably cultivated there. An Austrian Jew has discovered the means of depriving this grass of its silica and gum-resinous matters, and already in Austria and Switzerland there are two manufactories at work, employing only the pulp provided from this source. It is not only possible to produce from the leaf of the maize every kind of paper at present in use, but also a paper superior in many respects to that manufactured from rags. It requires but very little size to render it fit to receive writing-ink, as the leaf of the maize contains already a natural ingredient which takes the place of size, and which, moreover, can be easily eliminated if thought proper. M. Naudin, who reports upon this maize paper, thinks that it is preferable to employ only the leaves which envelope the spike, as they contain more fibre and less green and gummy matter than those of the stem. He proposes to experiment on old leaves which have long been used in paillasses, supposing that it will be easier to reduce them into paper-pulp.

The Bayswater Tramway.—It has been decided, it appears, to remove this first of the street railways. The adjourned meeting of the Metropolis Roads Commissioners in reference to this Railway was held at the offices, Whitehall-place. The previous meeting, on the 20th of June, was called by Lord Portman and Sir John Shelley, commissioners, and was numerously attended. On that occasion Mr Train applied for permission to extend his line of rails through Notting-hill, and also to make a double line, and the application was supported by a memorial signed by some thousand persons. On the other hand, Mr J. E. Bradfield applied that the original order made by the commissioners last November should be revoked, which application was supported by a memorial signed by Mr Beresford Hope, Lord Harrington, and about 2,000 of the most influential residents in the neighbourhood, and others, who claimed a free right of way over the highway. Mr Dunford and Mr Harvey appeared on behalf of the tradespeople of Notting-hill, and made a similar application to that of Mr Bradfield. The commissioners decided to take the opinion of counsel on a legal question; having met, they resolved by a large majority that the present rails should be removed, and the road restored to its original state; and they gave Mr Train to the 4th of October to carry out their resolution.

Scottish Commerce.—The Custom's receipts at Glasgow during the quarter ending the 30th ult., were L.230,767, as compared with L.226,506, in the corresponding quarter of 1860, and L.219,410 in the corresponding quarter of 1859. At Greenock the receipts were L.242,009, as compared with L.215.682 in the corresponding quarter of 1860; and L.260,298 in the corresponding quarter of 1859. At Port-Glasgow the receipts were L.22,117, as compared with L.32,672 in 1859. The revenue of the Clyde Navigation Trustees during the year ending the 30th ult. was L.105,707, as compared with L.97,983 in 1859 60. Commercial affairs continue in a languid state at Paisley, but on the whole there is more doing than might have been anticipated. The total importation of flax into Dundee, Aberdeen, Montrose, Arbroath, and Kirkcaldy, during the half-year ending the 30th ult. was 7782 tons, against 10,400 tons in the corresponding six months of 1860, and 11,097 tons in the corresponding six months of 1859. In the Dundee linen trade rather more orders have been given out of late, both for coarse. and fine fabrics. Last week's shipments of pig iron from Scottish ports were 12,970 tons, as compared with 11,603 tons in the corresponding week of last year, showing a continuance of the activity in this branch of the trade. The wool market continues quiet, but a little more inquiry has been manifested.

Rags.—A return has been recently made of the names of those countries in Europe which permit of the free export of rags, and of those other countries that prohibit such export, or impose a duty thereon, with the amount per ton of such duty in each case. In Russia the export duty is, by the ports in the Baltic and White Seas, and by land, £6 4s. 7d. per ton; by ports in the Black Sea, &c., £2 1s. 8d. per ton; in Sweden, £2 9s. 9d. per ton; in Norway, for rags (old), £3 16s. 3d. per ton; for cordage (old), £1 5s. 5d. per ton; in Denmark, £2 6s. 3d. per ton; in Hamburg, free; in Holland, for cotton or linen, £8 8s. 4d. per ton; for cordage (old), £2 10s. per ton. In Belgium the exportation is prohibited, except into France, where it is allowed at the French rates. These French rates, which apply only to exports into the United Kingdom or Belgium, exportation to other countries being prohibited, are—For all kinds, except woollen, £4 17s. 2d. per ton; for pulp for paper making, £4 17s. 2d. per ton; for old cordages, pitched or not, £1 9s. 4d. per ton. In Spain the export is prohibited; in Portugal the duty is £6 2s. 1d. per ton; in Italy, £1 12s. per ton; in Austria, £7 5s. per ton. Rags exported from Hungary, Croatia, Slavonia, and the military Croatian Slavonian frontier, by the ports of Trieste and Fiume, with the permission of the Finance Minister, are liable only to half this rate of duty. In the Zollverein the duty is:—For rags, £9 3s. per ton; for cordage (old), £1 0s. 4d. per ton. In Switzerland, £1 12s. 9d. per ton; in the Papal States, by the Mediterranean, £2 17s. per ton; by the Adriatic, £1 13s. per ton; in Greece, 1s. per ton; and in Turkey, 8 per cent., ad valorem.

On the Purification of Sugar.—The method of using freshly burned lime as a defecator of saccharine juices has long been known, but there has always been great difficulty in afterwards getting completely rid of the lime. Carbonic acid gas had usually been employed for this purpose, but there was always some lime left behind, and moreover, this gas had a certain injurious influence on the dissolved sugar. M. Rousseau, has lately proposed to employ sulphate of lime (gypsum) as it possesses the advantages of being nearly insoluble, of readily uniting with the albuminous matters of the juice, and of being cheap. When this matter is used the scum thrown off is said to be thick, and the juice can be drawn off in a sufficiently limped state. Whilst sulphate of lime acts well on the coagulable matters, it does not affect the deep colouring matter of the juice, and it is proposed to employ hydrated peroxyde of iron, after the albuminous substances have been removed, with the view of getting rid of the colour. This salt may be stirred into the juice either cold or at any temperature under the boiling point, and when it has been filtered, it will be found deprived of the greatest part of its colouring matter. This salt will also neutralize any small quantities of alkaline or earthy salts remaining therein. The chemist will understand its value when it is stated that the juice which, after undergoing defecation with sulphate of lime would have a reaction on nitrate of silver, or bioxyde of mercury will cease to possess such reaction after treatment with hydrated peroxyde of iron. The whole process is this; boil the crude juice with a few thousandth parts of sulphate of lime (common plaster of Paris is the best form) and the albuminous matters will be thrown up in a thick scum. Mix hydrated peroxyde of iron, of the consistence of a thick paste, with the clarified juice. The proportion of this salt will vary with the nature of the juice, but it should not under any circumstances exceed the juice by more than 8 or 10 per cent. In this quantity the salt is cheaper than animal charcoal. Juice treated by this process is said to possess all the properties that can be desired. The process has been more fully described in a communication lately laid by M. Rousseau before the Academy of Sciences at Paris.

Supply of Coal to the Metropolis.—For the quarter ending June 30 the returns show that 353,263 tons 16 cwt. of coal have been carried by various railways to the metropolis, and 4,795 tons 10 cwt. by canal, making a total of 358,059 tons 6 cwt. For the six months ending this date there has been the large increase of 124,197 tons 13 cwt. as compared with the corresponding period of last year, the coals by railway for the present year being 839,035 tons 16 cwt. against 714,838 tons 3 cwt. The canals show an increase of 468 tons 15 cwt. for the six months. During the quarter the London and North-Western have carried by far the largest proportion—viz., 177.547 tons 17 cwt.; Great Northern, 115,112 tons 16 cwt.; Eastern Counties, 45,360 tons; Great Western, 23,770 tons; Midland, 14,014 tons; Hertford, Luton, and Dunstable, 4,999 tons 15 cwt.; South-Eastern, 3,554 tons 5 cwt.; South-Western, 2.831 tons 4 cwt.; Chatham and Dover. 337 tons 10 cwt.; Tilbury and Southend, 198 tons. The monthly carriage has been as follows:—London and North-Western, 69,533 tons 16 cwt.; 61,086 tons 3 cwt.; and 46,967 tons 18 cwt. Great Northern, 42,431 tons 6 cwt.; 45,025 tons 15 cwt.; and 27,655 tons 15 cwt. Eastern Counties, 13,934 tons 3 cwt.; 15.125 tons; and 16,300 tons 17 cwt. Great Western, 7,462 tons; 8,816 tons; and 7.492 tons; Midland, 4,506 tons; 5,987 tons; and 3,521 tons; South-Eastern, 888 tons 18 cwt.; 2,665 tons 17 cwt.; and——. Hertford, Luton, and Dunstable, 1,549 tons 13 cwt.; 1,999 tons 5 cwt.; and 1,450 tons 17 cwt. South-Western, 1,505 tons 3 cwt.; 1,326 tons 1 cwt.; and ——. Tilbury and Southend, 30 tons; 126 tons; and 42 tons. Chatham and Dover, 337 tons 10 cwt. in June. Of the immense totals above given the Clay Cross pits have furnished no less than 55,210 tons 6 cwt., and the various Silkstone pits 34,544 tons 19 cwt.

Emigration.—In the year 1860, the emigration from the United Kingdom amounted to 128,409 persons and of these, 26,421 were English. 8,733 Scotch, 60,835 Irish. 4,536 foreigners, and 27.944 not distinguished; 9,746 were married men, 12,434 married women, 38,783 single men, 27,511 single women, 6,681 boys between the ages of 1 and 12, 6,497 girls between the same ages, 3,085 infants, and 23,732 not distinguished. 87,500 emigrants left these shores for the United States; 13,556 of these were English, 2,220 Scotch, 52,103 Irish, 3,851 foreigners, and 15,770 not distinguished; 6.553 were married men, 8,269 married women, 27,547 single men, 20,925 single women, 4,172 boys between the ages of 1 and 12, 4,178 girls between the same ages, 2,210 infants, and 13,646 not distinguished. Of the 24,302 who emigrated to the Australian colonies and New Zealand, 10,099 were English, 4,990 Scotch, 6,345 Irish, 578 foreigners, and 2,290 not distinguished; 2,380 were married men, 2,928 married women. 9,095 single men, 5,456 single women, 1,782 boys between the ages of 1 and 12, 1,628 girls between the same ages, 655 infants, 378 not distinguished. Of the 9,786 who emigrated to British North America, 559 were English. 991 Scotch, 1,215 Irish, 73 foreigners, and 6,948 not distinguished; 248 were married men. 371 married women, 1,089 single men, 606 single women, 259 boys between the ages of 1 and 12, 214 girls between the same ages, 95, infants, and 6,904 not distinguished Of the 6,881 who went to "all other places," 2,207 were English, 532 Scotch, 1,172 Irish, 34 foreigners, and 2,936 not distinguished; 565 were married men, 866 married women. 1,052 single men, 524 single women, 468 boys between the ages of 1 and 12, 477 girls between the same ages, 125 infants, and 2,804 not distinguished.

Ventilation.—A lecture on this interesting topic was lately delivered at the Hanover Square Rooms, by Mr Pepper. The principles of ventilation are based upon the well-known law of the expansion of all bodies, solid, liquid, or gaseous, by heat, and their contraction by cold. An iron rod, when heated in boiling water, refused to re-enter the gauge till restored to its former temperature; water rose in the thermometer by the application of heat; and a balloon filled with warm air by means of Leslie's gas stove ascended to the ceiling till the air became cool, when it immediately collapsed, and descended upon the heads of the audience. The various systems of ventilation now in vogue in the Houses of Parliament, in public buildings, dwelling-houses. and coal-mines were severally brought under the notice of the audience, and illustrated by various models and experiments. The importance of ventilation in its relation to human health was pointed out and further illustrated by reference to an able paper written by Miss Florence Nightingale in the transactions of the Society for Promoting Social Science. This lady's hospital experience was most valuable in pointing out the necessity for a continuous supply of fresh air, and plenty of it, for nothing could produce a more deleterious effect in the condition of the sick than a limited and impure supply of this healthy element. The danger of catching cold had been greatly exaggerated, more especially in a country like England, where fuel is cheap, and where the patient may be sufficiently protected by an ample supply of clothing. Nothing could compensate for a deficient supply of air; no artificial means would suffice; the only real remedy was to throw open the windows. and so obtain a plentiful inlet of pure air. The hospitals in Paris, though ample, and even magnificent in their dimensions, were incapable of conferring the whole of their possible advantages, from the simple reason that the ventilation was carried on by artificial means. In the morning, when the wards were opened they were found to contain a close and vitiated atmosphere, which was sure to exercise an unsalutary effect on the health of the patients. The simplest inventions in all matters of science were generally those of the widest practical utility. The inventions of Roscommon and Watt in the steam engine were unsurpassed in the simplicity of their action and their usefulness. The invention of the screw propeller consisted of nothing more than the application of one of the most elementary laws of mechanics; and the grandest and most wonderful discoveries of the age had not depended, as a rule, upon deep and abstruse researches into science, but the application by practical men of first and simple principles. In order to illustrate Mr Cooke's method, a small model of a house built in the ordinary way. was exhibited, to show the effects of the folds of wire gauze attached to the top of the window sashes. When ventilation was required, the window was pulled down and the gauze unfolded. admitting as much fresh air as was required without the usual accompaniment of a draught. Nine lighted candles were placed within a box, made air-tight, save one small crack over a door; the candles soon began to show symptoms of imperfect combustion, and the condition of some of them became so bad in a short time, that their light could with difficulty be saved by an application of the ventilator: those in a less advanced stage of decline were promptly restored. Under all the disadvantages of an experiment on a small scale like this, the plan was shown to be successful, and its adaptation to the window sashes of ordinary dwelling-houses at a trifling expense, may be considered a great improvement over the present clumsy method of procuring ventilation.

Emigration to Canada.—In 1860 there landed at Quebec 10,150 immigrants, of whom 2,491 were English, 2,831 Irish, 1,850 Scotch, 1,809 Norwegians, and 725 Germans. About three-fourths of the English and Scotch remained in Canada and about a fifth of the Irish, the rest proceeded on to the United States. But other immigrants arrived by other routes, and the whole statement for the year stands thus:—Landed at Quebec 10,150; arrived *via* United States, 4,829; making 15,042, of whom 7,152 proceeded to the United States and 7,827 remained in Canada—a larger number than in 1859 by above 1,500. 4,769 of these new-comers selected Western Canada to settle in, 614 the Ottawa district, 1,200 Eastern Canada. Although nearly all the Norwegians proceeded to join their large settlements in Illinois and Wisconsin, a small Norwegian settlement has been established at Gaspe, and it is hoped it will succeed, as the natives of Norway are by their former habits peculiarly adapted to that part of Canada, which has hitherto been almost rejected by all other European immigrants. Of the German families who have within the last two years settled on the upper Ottawa, 40, who brought with them a capital of only 75 dollars each, together 3,000 dollars, have property already of the value of nearly 12,000 dollars. A considerable proportion of the English and Scotch immigrants were farmers, many bringing with them a capital of from 300*l.* to 1,000*l.* The two classes most wanted are female servants and agricultural labourers—men who can plough and mow and reap, and who understand draining; and such men soon become landowners. During the abundant harvest of last year, 2 dollars a day were offered in vain by farmers for labour, and a larger supply will be in request this season, as the farmers are prosperous, and extending their operations, and the general prospects of the province have greatly improved. Of the assisted emigration ten youths who arrived from the Wandsworth and Leeds reformatories were directed up the Ottawa, where they were all immediately employed; and a party of 40 from Lord Palmerston's estates in the county of Sligo, who had been provided with a free passage, being all able young men and women, found immediate employment in the rural districts, although the young men had not been accustomed to agricultural pursuits. It appears that, in spite of reiterated warnings, skilled mechanics and clerks still present themselves in great numbers. It does not seem known that the posts of mercantile life are occupied by the sons of successful immigrant farmers. Mr Buchanan, the Government chief emigration agent, reports at the close of the year:—"The class of persons whom we want, and who cannot fail to do well, are those who, having a small amount of capital, are prepared to purchase and settle on our lands, and make homes for themselves in the forest, as the inhabitants of this free and fertile land have done before them; the hardships to be encountered now are less than they were 25 years ago, when a few thousand people were scattered over a long frontier of country." Or with a 100 or 200 dollars men can purchase the right of those who make it a business to chop and clear a few acres, erect a loghouse and sell. The mineral discoveries are attracting attention. It will be interesting to watch the effect of the civil war in the United States upon the European emigration of the present year.

Door and Window Draught Preventive.—With a keen appreciation of the injury and discomfort caused by the admission of draughts and dust which our present system of fitting doors, sashes, and casements cannot prevent, Mr John Brown of Norwich, Architect, has turned his attention to provide some simple means of doing away with the inconvenience. The improvement consists in the application of cloth-padded strips of pine or oak, which are fitted to windows, casements, doors, or other structural details where it is desired to exclude draughts, dust, or rain water. Fig. 1 of the accompanying illustrations represents the patentee's mode of inserting the cloth into strips of pine or oak. Prepared in this manner the padded wood strips are supplied ready for use to builders, carpenters, or others. Fig. 2 shows the applications of the padded strips to a sash door or casement bead, and to the bottom rail of the same. In the arrangement of the slips for casement heads, it is preferred to make a slight groove in the top rail of the casement to receive the rounded surface of the cloth. At the lower part of the casement the padded strip is arranged in a groove or rebate, so as to press when closed against an iron or brass water bar or stop, so as to exclude effectually draught, dust, or rain. Fig. 3 shows the application of the patent slips to window sashes, in which the slips are rebated into the styles of the sashes. In the modification delineated in fig. 4, the duplex slips are inserted in the parting bead. Fig. 5 represents an arrangement suitable for internal or external doors, the bottom strip is made to press upon a wedge-shaped stop when the door is closed. It is obvious that these padded slips may be applied to a great variety of useful purposes, the arrangement being modified to suit the particular object in view.

Fig. 1.

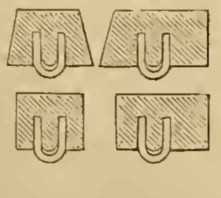


Fig. 2.

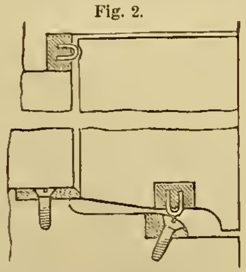


Fig. 3.

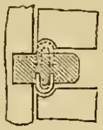


Fig. 4.

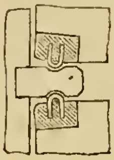
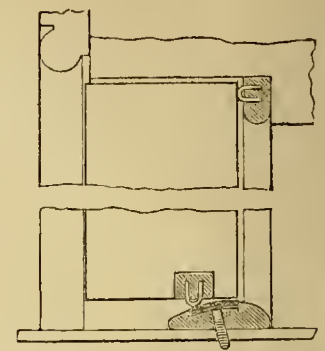


Fig. 5.



Vertical Oven Retort.—An arrangement of gas retort which combines economy of labour and material with the production of an increased quantity of gas, has been brought into successful use by the patentee, Mr William Richardson, C.E., of Dudley. The peculiar feature of this retort is that it may be charged three or four times in succession with fresh coal before withdrawing the coke. The subjoined engravings represent two sectional views of the improved retort. The furnace, A, is constructed in the ordinary manner; above this is arranged the retort, B, the height of which is considerably increased as compared with retorts of the ordinary kind. The retort is provided with duplex mouth-pieces, C and D, the upper one of which communicates by a single vertical pipe, F, with the hydraulic main, E. The lower mouth-piece, C, opens into duplex vertical pipes, G, which also dip into the hydraulic main. In working the retort the coal from which the gas is to be obtained is first charged through the lower mouth-piece, and the end cover is luted on the usual way. After this charge is worked off, the next charge is put into the retort through the upper mouth-piece, and upon the heated coke of the first charge. As the gas is evolved from the second charge of coal, it descends through the hot coke and passes off by the duplex pipes, F, into the hydraulic main. The escape of the gas in this direction is owing to a difference which is made in the dip of the vertical pipes, which admits of its escaping more readily by the lower mouth-piece. This arrangement results in producing a larger yield of gas with less tar and ammoniacal liquor; the quality of the coke is also improved in density, and it is consequently more valuable, because it is better suited for general use. The retort may be worked with a third or fourth charge of coal before withdrawing the coke, and in this way a considerable saving of labour is effected, as well as economising heat. The advantages of Mr Richardson's retorts are so evident, that we doubt not of their coming into general use.

Fig. 1.

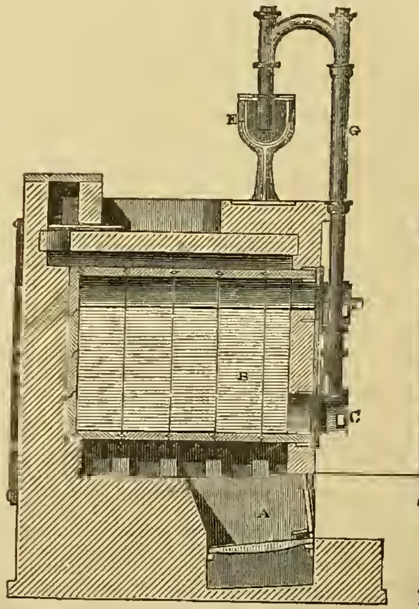
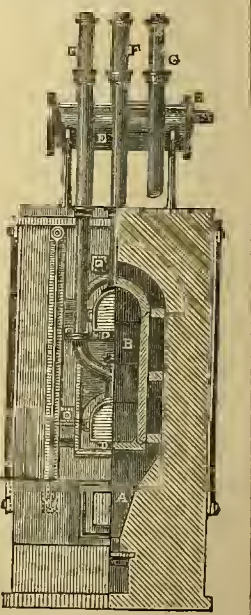


Fig. 2.



Factories.—In the recently published report of the Factory Inspectors they express regret that a large number of factories are running short time, and that there is no immediate prospect of a return to full time, and they add,—"This is a disheartening prospect for the operatives, but especially for those who have been out on strike during the early part of the year." At Ashton, Staleybridge, Glossop, and their neighbourhoods, the operatives were idle for a month, and then, receiving little support from the public, accepted the proposed reduction of wages; but the 30,000 who had thus thrown themselves out of work lost £20,000 a-week during the strike. It took place by the decision of their leaders, and of the Colne strike the operatives' secretary had to report:—"It was not ourselves who came out on strike, it was the East Lancashire Association who brought us out; we have kept out for near a year, and now they do not send us sufficient to subsist upon, and the employers refuse to employ a number of us whom they have placed on a 'black list.'" One of the inspectors, Mr Baker, notices the ignorance prevailing among the factory working classes on the subject of the law of supply and demand, and the folly of men spending the whole of their wages (higher wages and for less work than 20 years ago, and with the cost of living reduced), and yet thinking of striking successfully against capital. They appear, he says, not to see that trade is, and therefore wages must be, uncertain, and that a provision must be made for that uncertainty, but it is useless to attempt to force wages from trade when there is no demand. More communication between employers and men might, he thinks, remove some of the suspicions of the men, and it might often be made plain to both that it is their mutual interest to divide the probable loss on continuing to work to make stock without any profit. Of Coventry the inspector is able to report that the munificent contributions of the public—upwards of £40,000—were wisely expended. Without them Coventry must have sunk, for a long while, at all events. But not only is trade there improving, but there is a prospect of a future prosperity greater than has ever before been enjoyed. There are looms in Coventry now on which can be woven almost anything that can be woven on any loom in any country, and other branches of trade are springing up, especially muslin frilling in an ingenious mode, which is likely to rise into a great trade. Lord Leigh, has offered medals and prizes for designs in ribbons. Coventry ribbons are often now sold for French, and French for those of Coventry—a testimony, at all events, to the high character of our manufacture. The accidents of the half-year were, 2,232 in number, in 29 instances causing death, in 33 the loss of a limb, in 166 amputation of part of hand or arm, an unfortunate result of the employment of machinery.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

18th June, 1861.

1567. William E. Newton, Chancery Lane—Improvements in electro-magnetic engines.—(Communication from George Beardslee, Long Island, New York, U.S.)

1568. Thomas Webb and James Craig, Tutbury, Staffordshire—Improvements in machinery or apparatus for spinning, doubling, and winding cotton and other fibrous materials.

1569. Joseph E. Kirby, Banbury, Oxon—Improvements in steam engines and machinery for giving motion to agricultural implements and other machines.

1570. John Dixon, Gallowgate Works, Newcastle-on-Tyne—Improvements in water-closets and cocks used therewith.

1571. Thomas T. Jobling, Sunderland—Improvements in machinery for the manufacture of bolts, spikes, screw-blanks and rivets.

19th June, 1861.

1572. John Louch, Fenchurch Street—Improvements in furnaces, boilers, and condensers of steam engines, part of such improvements being applicable to other purposes.

1573. Charles E. Butler, Birmingham, Warwickshire—An improvement or improvements in the manufacture of riddles or sieves.

1574. William Clark, Chancery Lane—Improvements in umbrellas and parasols.—(Communication from Pierre Allamagny, Boulevart St Martin, Paris.)

1575. James Fisken, Wharf Road, City Road—Glazing or calendering by steam, horse, or water power textile fabrics which have been worn, made up for use. or sewn together.

1576. Philipp Schafer and Frederick Schafer, Golden Square—Improvements in travelling bags or cases.

1577. Peter Pradel, Paris—An improved clasp or fastener.

1578. Joseph Faulding, Euston Road, N.W.,—Improvements in locomotive engines.

1579. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in brakes for railroad cars.—(Communication from Conrad B. Lasher, New York, U.S.)

1580. John F. Williams, Queen Square, St. George the Martyr—Improvements in compounds of India rubber and gutta percha with other substances.

1581. William J. Harris, Liverpool—Improvements in dry gas meters.—(Communication from Joseph A. Sabbaton, New York, U.S.)

1582. John Cullen, Bow—Improvements in preserving wood and iron.

20th June, 1861.

1583. Louis Hannart, Brussels, Belgium—An improvement in the manufacture of gloves.

1584. James Fletcher and John W. Fuller, Salford, Lancashire—Certain improvements in machines for planing, boring, and turning.

1585. Charles Stevens, Charing Cross—Improvements in spiral springs.—(Communication from Adolphe Loncq, Rue Laffitte, Paris.)

1586. Michel F. A. T. de Menonville, Rue Laffitte, Paris—A new system of condensing and ventilating.

1587. Henry Lawford, Berners Street—Improvements in folding chairs, folding beds, folding arm chair beds, folding couch beds, and other articles for sitting, reclining, and lying upon.

1588. Charles Stevens, Charing Cross—Improvements in smoke consuming furnaces.—(Communication from Antoine L. Lacroix, Rue Laffitte, Paris.)

1589. William E. Gedge, Wellington Street, Strand—Improved means or apparatus for drying, sifting, and cleansing grain and other agricultural produce.—(Communication from Antoine A. Dubard-Dutarbre, Dijon, France.)

1590. Antoine N. Lesueur, Paris—A new system of crockery-ware, pannels, or of materials of the same kind.

1591. Richard A. Brooman, Fleet Street—Improvements in pianofortes, parts of which improvements are applicable to other musical instruments, and to apparatuses worked by pedals.—(Communication from Jean L. Clement, Rochefort, France.)

1592. Charles Hodgson, Ballard Rathdrum, Wicklow—Improvements in the manufacture of fuel from peat and in apparatus employed therein, parts of which are applicable to the moulding of bricks, tiles, and other like materials.

1593. Charles Hodgson, Ballard Rathdrum, Wicklow—An improved method of partially drying peat before removing the same from the bog.

1594. John H. Bartholf, New Oxford Street—Improvements in the construction of children's nursery chairs, and in apparatus for use in combination with the same.—(Communication from George B. Hartson, New York, U.S.)

1595. William E. Marsily, Antwerp—Improvements in velocipedes.

21st June, 1861.

1596. George Turner, Rose Terrace, Brompton—Improvements in apparatus for beating eggs and for mixing or agitating other fluids, compounds, or matters.

1597. John S. Wright, Birmingham, Warwickshire—Improvements in reels or spools.

1598. John Hannan and John Hamilton, Glasgow, Lanarkshire—Improvements in engine indicators.

1599. Thomas R. Harding, Leeds, Yorkshire—Improvements in the pointing of steel or other wire for teeth of cards, and in setting and fixing such or similar teeth into sheets or fillets, which improvements are applicable to the pins for hackles and gills and in part to the pointing of needles.

1600. William F. Honson, New Cavendish Street, Portland Place—Improvements in the manufacture of floor-cloth and in the means of ornamenting the same.

1601. William Hobson, Ellesmere Road, Sheffield, Yorkshire—Improvements in steam hammers.

1602. William Hobson and Thomas Cavill, Sheffield, Yorkshire—An improved piston.

1603. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the reproduction of forms of objects applicable to the production of printing surfaces.—(Communication from Louis Kessler and Joseph A. X. Michiels, Paris.)

22d June, 1861.

1604. Auguste L. Le Harivel, Tufnell Park Road, Upper Holloway—Improvements in the manufacture of paper papier mache cardboard and other similar articles.

1605. Pierre H. A. C. Sapia, Paris—Improvements in instruments for measuring angles and distances.

1606. Jabez Church, Upper Kennington Lane, Vauxhall, Surrey—An improved stand or rest for pianofortes or other musical instruments.

1607. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the manufacture of floor tiles and paving blocks.—(Communication from Sylvan Tolijon, Paris.)

1608. James Comrie, Stirling—Improvements in churns.

1609. Robert Ormerod, Manchester, Lancashire—Certain improvements in the manufacture of ornamental or fancy ribbons and in the machinery or apparatus connected therewith.

1610. Robert Russell, Sheffield, Yorkshire—An improved valve to regulate the passage of fluids.

1611. James S. McArdle, Galway, Ireland—Improvements in the treatment of sea weeds for the purpose of obtaining therefrom certain valuable products.

1612. John Cole and Joseph Cole, Coventry, Warwickshire—An improvement in the construction of watches.

24th June, 1861.

1613. Enoch Dance, Bolton, Lancashire—A new or improved crinoline fastener.

1614. Robert Moore, Cannon Street West—Improvements in the construction, steering, and propelling of ships and other floating bodies and appliances adapted thereto.

1615. James Ferrabee, Stroud, Gloucestershire—Improvements in machines for fulling woollen and other fabrics and in the method of driving the same.

1616. Richard Howson, Middlesbro' on Tees, Yorkshire—Improvements in barometers.

25th June, 1861.

1617. Henry B. Barlow, Manchester—Improvements in knitting machinery. (Communication from Nicholas Berthelot, Paris.)

1618. William E. Gedge, Wellington Street, Strand—Improved means or apparatus for doubling and twisting the threads of any material by every material which can be carded or combed. (Communication from Joseph S. Mansion, Passage des Petites Ecuries, Paris.)

1619. Jules Lafon, Bordeaux, Gironde, France—Improvements in the production of chromo lithographic impressions upon glass, porcelain, and other similar material.

1620. Louis Pierre, Niort, Deux Sevres, France—A system of iron windows.

1621. William Clark, Chancery Lane—Improvements in apparatus for propelling vessels. (Communication from Mr Paolo de Scalzi, Genoa, Sardinia.)

1622. James Brown, Newport, Monmouthshire—An improvement in the manufacture of iron.

1623. Frederick Warren, Birmingham—Improvements in the machine used for cleaning cotton, and commonly called "Churka or roller gin."

1624. Charles Stevens, Charing Cross—An improved noseband for stopping runaway horses. (Communication from Louis Marque, Rue Laffitte, Paris.)

1625. Charles Stevens, Charing Cross—An improved brick-making machine. (Communication from Louis F. F. David, Rue Laffitte, Paris.)

1626. Augustus Sacre, Brussels, Belgium—Improvements in machinery for preparing and spinning flax or other fibrous matters.

1627. John Brown, Upper King Street, Norwich—Improvements in window frames and blinds.

1628. John Fowler, jun., Leeds, Yorkshire—Improvements in machines for ploughing or tilling land by steam power.

26th June, 1861.

1629. Stephen Wenton, Lower Rosoman Street, Clerkenwell—Improvements in ventilating apparatus.

1630. William Holland, Warwickshire—Improvement or improvements in suspending and raising and lowering window sashes.

1631. John Redfern, Hanley, Staffordshire—Improved apparatus for raising the temperature of air, in order to warm churches, conservatories, houses, and other buildings or places.

1632. Edward Abbotts, Lingard, Birmingham, Warwickshire—Improvements in fastenings for jewellery or other articles.

1633. Marc A. F. Mennons, Rue de l'Echiquier, Paris—A new or improved construction of caloric engines. (Communication from Nicolas de Telescheff, Iver, Russia.)

1634. Joseph R. Tussand and Francis C. Tussaud, Marylebone Road—Improvements in obtaining the separation of feathers, hair, or other covering from the skins of animals, and in securing such in position when separated.)

1635. Henry A. Fletcher, Whitehaven, Cumberland—Improvements in railway wheels and tyres.

1636. Henry Coulter, Philadelphia, U. S.—Improvements in lamps specially intended to burn oils and other inflammable fluids rich in carbon.

1637. James Higgins, and Thomas S. Whitworth, Lancashire—Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials.

1638. Samuel A. Bell, Epping Villas, Stratford, Essex—Improved machinery or apparatus for arranging and securing splints, tapers, or matches in frames, preparatory to dipping.

1639. Auguste Lion, Rue de Malte, Paris—Certain improvements in the fastening of bracelets.

1640. John Cowan, Surrey—Improvements in apparatus for reburning animal charcoal.

27th June, 1861.

1641. Doctor F. Grimaldi, Trinity Square, Borough, S.E.—Improvements in rotatory steam boilers.

1642. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in cocks or taps for drawing off liquids, and in gauging apparatus connected therewith. (Communication from Auguste Terre and Etienne Morelle, Versailles, France.)

1643. William M'Naught, Manchester, Lancashire—Certain improvements in steam engines.

1644. Henry Coulter, Philadelphia, U.S.—Improvements in door springs. (Communication from John O. Blythe, Germantown, Philadelphia, U.S.)

1645. Henry Hamer, Horsforth, near Leeds, Yorkshire—Improvements in chimney tops and ventilators.

1646. John C. Smart, and Adam Aitchison, Scarboro, Yorkshire—Improvements in the manufacture of charcoal.

1647. John Doughty, Craven Buildings, Drury Lane—Improvements in obtaining and applying motive power.

1648. Michael Henry, Fleet Street—Improvements in the construction of a certain description of castor, and in apparatus for manufacturing certain parts of such castors, which apparatus may also be applied for producing rounded bodies for other purposes. (Communication from Jean B. G. Clergean, Boulevard Saint Martin, Paris.)

28th June, 1861.

1649. James Gibson, Todmorden, Yorkshire—Certain improvements in or applicable to sewing machines.

1650. Thomas Swinnerton, Dudley, Port Tipton, Staffordshire—A new or improved manufacture of coal gas by the surplus or waste heat of the blast ovens and puddling furnaces used in the manufacture of iron.

1651. Alfred Ford, Suthrey House, Mortlake, Surrey—Improvements in the manufacture of waterproof felt.

1652. John W. Harland, Chorlton-on-Medlock, Manchester—An improvement or improvements in the manufacture of wood and other types or substitutes therefore, and also in the matrix or apparatus for producing the same.

1653. Joshua W. Graham, Manchester, Lancashire—Certain improvements in machinery or apparatus for cutting, shaping, and dressing stone or other similar substances.

1654. Henry J. Rouse, Alexandria, Egypt—An improvement in hand lamps.

1655. David B. White, Newcastle-upon-Tyne—Improvements in compressing and in apparatus employed therein.

1656. Samuel Middleton and John Wright, Bridge Street, Blackfriars—Improvements in apparatus for the manufacture of boots and shoes, and other articles composed of leather and such like materials.

1657. Michael Lane, Reading—Improvements in the permanent ways of railways.

1658. Charles Glassborow, Rheidol Terrace, Islington—Improvements in pianofortes.

1659. James B. Hawkins, North Street, Limehouse—Improvements in the construction of cocks for drawing off liquids and vapours, and for regulating the flow or passage thereof.

29th June, 1861.

1660. Robert N. Eagle, U.S.—Improvements in riding stirrups.

1661. John Dyer, Islington—Improvements in the ornamentation of certain cabinet furniture.

1662. Alfred Wood, Lewes, Sussex—Improvements in the construction of fermenting tuns and apparatus for storing beer.

1663. William Leopard, Hurstpierpoint, Sussex—Improvements in railway brake apparatus.

1664. William Clark, Chancery Lane—A new locomotive apparatus having a movement resembling walking.—(Communication from Messrs Thomas Hanlon, George Hanlon, William Hanlon, Alfred Hanlon, Edward Hanlon, and Frederick Hanlon, New York, U.S.)

1665. William Clark, Chancery Lane—Improvements in excavating machinery.—(Communication from Messrs Francis B. Scott, James Brayley, and John B. Pitts, Buffalo, Erie, New York, U.S.)

1666. William Clark, Chancery Lane—Improvements in the destructive distillation of solid and liquid matters.—(Communication from Etienne C. Z. Bouchard, Boulevart St. Martin, Paris.)

1667. Isaac Bragg, Hensingham, Whitehaven, Cumberland—An improvement in the construction of reaping and mowing machines.

1668. Alfred V. Newton, Chancery Lane—Improvements in lapping used in machinery for printing textile fabrics, part of which improvements is applicable to driving bands.—(Communication from Seth Baker, Providence, Rhode Island, U.S.)

1669. William Livesey, Park Cottages, Park Village East—Improvements in wet gas meters.

1st July, 1861.

1670. William Dingwall, Dundee, Forfarshire—Improvements in fluid meters.

1671. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in apparatus for manufacturing and bottling aerated liquids.—(Communication from Messieurs Mondodot, Freres, Paris.)

1672. Ferdinand Potts, Lombard Street, Birmingham, and Richard Cox, Birmingham, Warwickshire—An improved mode of treating tubes used for posts for metallic bedsteads and other purposes, and in the machine for producing the same, and which said machine is also applicable for cutting out and piercing articles of sheet metal such as washers, metallic bucket ears, and other such like articles.

1673 James Shepherd and William Goodfellow, Manchester, Lancashire—An improved surface screen and sediment collector for steam boilers.

1674. Lewis H. Spence, Hatton Garden—Improvements in means or apparatus for the manufacture of paper bags or envelopes.—(Communication from Augustus Roolle, Bethlehem, Pennsylvania, U.S.)

2d July, 1861.

1675. William Barber, Stockport—Improvements in the manufacture of hats.

1676. Sophia Helbronner-Gerstle, Paris—Improvements in the manufacture of needle or tapestry work and coloured embroiderings.

1677. Jacques P. E. Paignon, Joseph M. Vaudaux, and Gaspard Gagniere, Paris.—Improvements in jacquard machines, with the object of allowing the substitution of endless paper in lieu of the pasteboard pattern cards hitherto used therein, and in machines for perforating the said paper.

1678. James Potts, Flint Street, Old Kent Road, Surrey—Improvements in machinery for sounding fog bells and other bells.

1679. Joshua G. Wilson, Rastrick, Halifax, Yorkshire—Improvements in the means or apparatus employed for feeding steam boilers with hot water.

1680. Abner Hill, Bamford Mills, Hathersage, Derbyshire—Improvements in spinning and doubling machinery.

1681. Hobert H. Bishop, Leicester Street, Leicester Square—Improvements in sewing machines.

1682. Michael Henry, Fleet Street—Improvements in or applicable to pianofortes and other musical instruments.—(Communication from Jean J. Cauderes, Boulevard St. Martin, Paris.)

1683. Samuel Adams, West Bromwich, Staffordshire—Improvements in omnibuses for street railways, part of which is applicable to other carriages.

3d July, 1861.

1684. Henry B. Barlow, Manchester—Certain improvements in machinery for spinning.—(Communication from Messieurs Harmel, Brothers, Paris.)

1685. Robert Richardson, Great George Street, Westminster—An improved railway chair for railways.

1686. Joseph Terry, Birmingham, Warwickshire—An improvement or improvements in the manufacture of window sash pulleys, side pulleys, screw pulleys, and upright pulleys.

1687. Joseph Woollatt, Preston, Lancashire—Improvements in looms.

1688. John Simonton, Belfast, Antrim—An improved traction engine and apparatus applicable for the cultivation of land.

1689. James Bennie and William Moffat, Johnstone, Renfrewshire—Improvements in the manufacture of heels, clogirons, horse-shoes, chain links, and similar articles, and in apparatus therefor.

1690. George Davies, Serle Street, Lincoln's Inn—Improvements in apparatus for grinding corn and other matters.—(Communication from Charles P. Nezeraux, Paris.)

1691. Charles Gilfoy, Southampton—Improved means of resisting and extinguishing fire in buildings, or on board ship.

1692. Richard Jolley, St. John Street, Smithfield—An air tight enclosure for heating, cooling, or drying, infusing, extracting, or absorbing vapours and gases for manufacturing medical or domestic purposes, and for preserving liquids and solids alimentary or otherwise.

1693. John F. Spencer, Newcastle-upon-Tyne—Improvements in steam engines, and the machinery and apparatus connected therewith.

1694. John Petrie, Jun., Rochdale, Lancashire—Improvements in machinery or apparatus for washing and drying wool, cotton, and other fibrous materials requiring similar treatment.

1695. Peter Spence, Newton Heath, near Manchester, Lancashire—Improvements in economizing the manufacture of sulphuric acid, and in obtaining copper from ores used in such manufacture.

1696. Victor C. Givry, Old Bond Street—Improvements in sewing machines.—(Communication from Louis T. Givry, Rue Saint Lazare, Paris.)

4th July, 1861.

1697. John Patterson, Beverley, Yorkshire—Improvements in machinery for applying the power of horses or other animals to drive mills or other machines.

1698. Johann Kull, Lanzburg, Canton Aargau, Switzerland, and Charles A. Caspar, Stanley Terrace, Studley Road, Stockwell—Level measurements on an entirely new principle called "Level balances."

1699. Richard Mills, Bury, Lancashire—Improvements in washing, wringing, and mangling machines.

1700. James M. Gale, Glasgow, Lanarkshire, and Thomas Kennedy, Kilmarnock, Ayrshire—Improvements in taps or valves.

1701. William H. Ludford, Staveley, Derbyshire—An improvement or improvements in the manufacture of brooms and scrubbing brushes.

1702. William E. Newton, Chancery Lane—Improvements in engines for obtaining motive power, part of which improvements may be employed for sounding steam whistles.—(Communication from Robert Rogers, Philadelphia, U.S.)

1703. John Webster, Gloucester Street, Pimlico—Improvements in compositions used for lubricating railway and other axles.

1704. Thomas Wilson and James G. Tatters, Felling, near Gateshead-on-Tyne—Improvements in treating tank refuse or soda waste.

1705. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the construction and arrangement of apparatus for the manufacture of ice and for the refrigeration of solid and fluid masses in general.—(Communication from Edouard Blee, Paris.)

1706. Bevan G. Sloper, Hackney—An improved method of and machinery for amalgamating and for effecting the separation of gold from earthy and other matters containing the same.

5th July, 1861.

1707. Benjamin Fowler, yr., Liverpool, Lancashire—An improved sewer and sink trap.

1708. John Hutson, Richmond, Surrey—Improvements in cornices, laths, and panels, for bedsteads and other articles of furniture.

1709. Osmund Williams, Dursley, Gloucestershire—An improved mixture or liquid for extinguishing fire, applicable also for preparing or saturating various kinds of materials and fabrics for the purpose of rendering the sane non-inflammable.

1710. William E. Gedge, Wellington Street, Strand—Improvements in obtaining motive power.—(Communication from Monsieur Main-Guillon, Fontenay le Comte, Vendee, France.)

1711. Jules E. M. de Pradon and Louis G. Lecoq, Rue Sainte Appoline, Paris—Improvements in apparatus for lighting.

1712. Robert Lakin, Ardwick, and John Wain, Manchester, Lancashire—Improvements in certain machines used in preparing to be spun, and in spinning cotton, wool, and other fibrous substances.

1713. William England, Stourbridge, Worcestershire—An improvement or improvements in the manufacture of bricks.

1714. Lewis Roughton, Bedford Place, Old Kent Road, Surrey—Improved apparatus for extinguishing fires.

6th July, 1861.

1715. John Dean, Derbyshire—Improvements in machinery or apparatus for propelling vessels.

1716. James R. Black, Sumner Place, Onslow Square, and Henry W. Spratt, Walbrook Buildings—Improvements in the manufacture of boxes, cases, tubes rings, and such like articles and machinery for the same.

1717. Robert A. Smith, Devonshire Street, Manchester—Improvements in purifying gas.

1718. Thomas Wilson, Birmingham, Warwickshire—An improvement or improvements in moveable spanners or screw wrenches.

1719. John E. Reid, Fleming Road, Newington, Surrey—A safety window sash fastener and draught excluder.

1720. Hermann Schutt, Bradford, Yorkshire—Improvements in spinning frames for spinning wool, cotton, silk, or flax and other fibrous material.—(Communication from William and Theodor Schmidt, Altenburg, Saxony.)

1721. Thomas Smith, Bolton Place, Upper Church Street, Fulham Road—Improvements in the construction of bells.

1722. William Pask, Sydney, Gloucestershire—Procuring a very valuable colouring matter from iron stone of so inferior a character as usually to be thrown aside as worthless, both in the manufacture of iron and of colouring matter.

1723. James Ridsdale, Stoke Newington Green—Improvements in inkstands, applicable to the stoppers of bottles.

1724. Louis A. Keiley, Gloucester Terrace, Camden Hill, Kensington, William A. O'Doherty, Swan Lane, Upper Thames Street—A certain improved method of and apparatus for facilitating the process of grass edge cutting or edge cutting in general.

1725. Charles Farrow, Great Tower Street—Improvements in apparatus for affixing or applying capsules to the necks of bottles and other vessels.

1726. Alfred Noblo, Bristol—Improvements in obtaining products from alkali waste and gas lime refuse.

1727. Elias R. Handcock, Norfolk Street, Strand—Improvements in machinery for obtaining and applying motive power.

1728. George Tutill, City Road—Improvements in treating materials for the manufacture of banners and flags.

8th July, 1861.

1729. Jacob Snider, Jun., Rue Gaillion, Paris—A method of utilizing old or smooth bore cannon by strengthening and rifling them so as to render them efficient to fire elongated or cylindro-conoidal projectiles.

1730. Frederick Warner, Crescent, Jewin Street, and Thomas Clark, Baldwin Street, City Road—Improvements in apparatus for supplying water to water closets.

1731. Richard Hornsby, Jun., Grantham, Lincolnshire—Improvements in machinery for washing, wringing, mangling, and churning.

1732. Thomas Cobley, Meerholz, Germany—An improved process for the manufacture of fluo-silicates and silicates of lead and baryta, and for the application of the same to various purposes in the arts and manufactures.

9th July, 1861.

1733. Thomas T. Macneill, Cockspur Street—Improvements in the construction of barometers, and in apparatus for registering the indications of the same.

1734. Thomas Cobley, Meerholz, Germany—An improved process for the treatment of silicates of metallic and non-metallic bases and other siliceous compounds, as slags, scoride, and such like, in order to recover the said bases, and also in the production of fluo-silicic and silicic acids.

1735. Alfred Priest and William Woolnough, yr., Kingston on Thames, Surrey—Improvements in machinery for drilling and hoeing land.

1736. George S. Parkinson, Lambton Terrace, Kensington—Improvements in perforated materials in combination with india rubber.

1737. Edwin A. Penley, Cheltenham, Gloucestershire—Improvements in the construction of drawing boards.

1738. Frederick S. Barff, Dublin—A new or improved process for the induration and preservation of stone and other analogous absorbent substances or materials, which process is also applicable to the production of artificial stone.

1739. William C. Parkinson, Cottage Lane, City Road—An improved frictionless bearing for gas meters.

1740. John Keats and George E. Keats, Leek, Staffordshire—Improvements in sewing machinery.

1741. Charles Cochrane, Middlesborough-on-Tees—Improvements in treating gas in its passage from blast furnaces to the furnaces, stoves, boilers, or other heating apparatus where the gas is employed.

1742. Richard Hornsby, jun., Grantham, Lincolnshire—Improvements in thrashing machines.

1743. Joseph German, Friar Gate, and George N. Browne, Kedleston Road, Derbyshire—Improvements in apparatus to be used in shampooing,

10th July, 1861.

1744. Thomas T. Chellingworth, Buckingham Street, Adelphi, C.E., and Jonathan Thurlow, Belvedere Road, Lambeth—Improvements in traction engines.

11th July, 1861.

1745. William Cooke, Spring Gardens—A wind guard for curing smoky chimneys.

1746. George Weston and James Weston, Sheffield, Yorkshire—Improvements in rotary steam engines and pumps.

1747. Patrick Adie, Strand—Improvements in means or machinery for preventing damage in railway accidents.

1748. Joshua Kidd, Strand—Improvements in the manufacture, application, and combustion of gases, and in apparatus connected therewith.

1749. John C. B. Salt, Birmingham, Warwickshire—A new or improved manufacture of street plates, name plates, and other plates or surfaces having inscriptions or devices thereon.

1750. James Farron, Ashton-under-Lyne, Lancashire—Improvements in apparatus and fittings connected with steam engines and boilers.

1751. Joseph R. Cotter, Donoughmore Rectory, Cork, Ireland—Certain improvements in the piano-forte.

1752. Thomas Reeves, jun., Bratton Westbury, Wiltshire—Improvements in apparatus for applying salt or other material to the roots of weeds.

1753. William Wilkinson, Bayswater—Improvements in manufacturing and ornamenting brushes, parts of which are applicable to ornamenting baskets and articles of furniture and to protecting silver or glass.

1754. Thomas G. Messenger, High Street, Loughborough, Leicester—Improvements in the construction of valves.

1755. Henry Ashwell, New Basford, Nottingham—Improvements in apparatus for washing, cleansing, scouring, getting up, dyeing, boiling, and steaming.

12th July, 1861.

1756. Thomas J. Smith, Queen Street, Cheapside—Improvements in photographic albums.

1757. William B. Adams, Holly Mount, Hampstead—Improvements in locomotive engines, trains, and their rails, parts thereof applicable to fixed engines.

1758. John Adams, King William Street—Improvements in revolving fire-arms, and in cartridges for the same.

1759. Samuel Berchtold, Frith Street, Soho—Improvements in perpetual calendars, to be used either separately or in connection with watches or clocks.

13*th July*, 1861.

1760. George Rydell, Dewsbury, Yorkshire—A smoke consumer and condenser suitable for factories, railway engines, steam ships, furnaces brick kilns, cinder ovens, bakehouses and other purposes, namely, ventilation of factories, houses of parliament, places of public worship, public institutions, dwelling houses, streets, coalmines, railway tunnels, mineral mines, iron works.

1761. Pierre J. De Rette, Rue Guimard, Bruxelles—Improvements in wind instruments of music in brass or other metal by perfecting their mechanism.

1762. Charles Maschwitz, yr., Birmingham, Warwickshire—Improvements in taps or stop-cocks for liquids, steam and gas.—(Communication from Joseph Berger, Biala, Austrian Galicia.)

1763. Isaac Beamish, Liverpool, Lancashire, and Noah Beamish, Egremont, Cheshire—Improvements in lubricating those parts of steam engines acted on by the steam, and in apparatus for the same, which said apparatus can be used for other purposes.

1764. James Pickering, Clitheroe, Henry Pickering, Burnley, and Nathan Pickering, Wingates, Westhoughton, Lancashire—Improvements in self-acting mules for spinning cotton and other fibrous materials.

1765. Louis George, Duke Street, Lincoln's Inn Fields—A mode of soldering together two or more printing type letters to facilitate the work of the compositor, and arranging the type cases for same, which may be called English breviotypy.

1766. Frederick Tolhausen, Boulevart Bonne Nouvelle, Paris—Improvements in looms for weaving ribbons and other fabrics.—(Communication from Georges Duplay, Rue Notre Dame St. Etienne, France.)

1767. Thomas Smith and George Taylor, Ipswich—Improvements in horse rakes and cultivators, and in wheels for the same and other carriages.

15*th July*, 1861.

1768. Theodor Woycke, America Square—An improvement in the manufacture, construction, and production of the heels and the uppers immediately above the heels of boots and shoes for imparting durability and permanency of form to the said heels and uppers.

1769. Edward Briggs and Samuel Fearnley, Rochdale, Lancashire—Improvements in the manufacture of piled fabrics, and in the machinery or apparatus employed in manufacturing piled and other fabrics.

1770. Thomas Walker, jun., Otley, Yorkshire—Certain improvements in apparatus for polarising light applicable to microscopes and other optical instruments.

1771. George Treble, yr., Aldersgate Street—An improvement in show cases.

1772. Thomas Cobley, Meerholz, Germany—Improvements in the manufacture of metallic and earthy silicates or silicious compounds of the same from the metallic and earthy bases or their salts and soluble alkaline, silicates, the formation of alkaline acetates or caustic alkalines, and application of the same.

1773. Thomas Cobley, Meerholz, Germany—A process for preserving and indurating timber, wood, and other vegetable matters, and for rendering the same uninflammable.

1774. Rees Taylor and Thomas Price, Bassalog, Monmouth—Improvements in the manufacture of tin and terne plates.

1775. James C. Coombe and James Wright, Bridge Street, Blackfriars—Improvements in the manufacture of pottery, porcelain and other ceramic and plastic wares, also in the method of and means for preserving stones, bricks, and such like materials.

1776. Thomas Cobley, Meerholz, Germany—A process for the production or manufacture of fluo-silicates of tin, zinc, and baryta, and their application as pigments for glazing, enamelling, and in the manufacture of glass.

1777. Benjamin Browne, King William Street—Improved machinery for clearing and smoothing spun thread or yarns and other similar fibrous materials.—(Communication from Eugene Ah-der-Halden and Charles Seiler, Vosges, France.)

1778. Alfred Topham, Joseph Topham and Jabez Topham, St. Pierre les Calais, France—Improvements in the manufacture of lace.

1779. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery or apparatus for cleaning rice.—(Communication from Henry B. Sears, New York, U.S.)

1780. John T. Gössell, Moorgate Street—Improvements in railway carriages.—(Communication from Heinrich Ehrhardt, Dresden, Saxony.)

1781. William Rigby, Glasgow, Lanarkshire—Improvements in the manufacture of armour plates for defensive purposes.

1782. John Mabson, Newcastle-upon-Tyne—Improvements in sewing-machines, particularly applicable to quilting and braiding.

1783. Emile G. F. de la Provotais, Boulevart St. Martin, Paris—Extracting the fibres from genista scoparia (broom) and their application to manufacturing paper and fabrics, and also treating the washing waters so as to obtain dyeing products therefrom.

1784. William Clark, Chancery Lane—Improvements in stage scenery and apparatus.—(Communication from Theophile Foucalt, Boulevart St. Martin, Paris.)

16*th July*, 1861.

1785. James Mapplo, Newman's Place, Kentish Town—Improvements in telegraphic apparatus.

1786. John Goucher, Worksop, Nottingham—Improvements in stacking corn and other crops.

1787. John S. Wells, Mount Street, Nottingham—An improved needle used in the manufacture of looped fabrics.

1788. John Blinkhorn, Chorley, Lancashire—Improvements in machinery or apparatus for working railway signals.

1789. Richard Jones, Camden Town—Improvements in safety lamps.

1790. Joseph P. Gillard, Paris—Improvements in the manufacture of soda, carbonate of soda, and hydrochloric acid.

1791. Daniel Holden, jr., Thornhill Road, Barnsbury—Improvements in foot and kneeling stools.

1792. Charles D. Abel, Southampton Buildings, Chancery Lane—Certain new alloys of silver with other metals, and the processes employed in their manufacture.—(Communication from Henri C. de Ruolz, Paris.)

1793. William Palmer, Sutton Street, Clerkenwell—Improvements in lamps.

17*th July*, 1861.

1794. Andrew W. Harnett, Guildford Street, Russell Square—The improved construction of steam engines, air engines, and pumps.

1795. Joseph H. Butterworth, Rochdale, Lancashire—An improved mode of, and apparatus for, heating water or other fluids.—(Communication from I. Eugene Tourne, New Orleans, Louisiana, U.S.)

1796. Joseph H. Butterworth, Rochdale, Lancashire—An improved mode of, and apparatus for, heating air or for desiccating wet or moist substances.—(Communication from I. Eugene Tourne, New Orleans, Louisiana, U.S.)

1797. John Parker, Ivy House, Bradford, Joseph Wells, and Benjamin Wells, Bowling, Bradford, Yorkshire—Improvements in steam engines, boilers, furnaces, and apparatus applicable thereto.

1798. Josiah Mason, Birmingham, Warwickshire—An improvement or improvements in metallic pens.—(Communication from Jean B. Mallat and Edme V. Saglier, Paris.)

1799. Charles E. Redfern, Saint Paul Street, New North Road, Islington—Improvements in the construction of locks, and adaptation thereof to various useful purposes.

1800. Sir William O'S. Brooke, Westminster—Improvements in apparatus for suspending and insulating electric telegraph wires.

1801. Sir John Hare, Pas de Calais, France, and Barnabus Russ, Frogmore Street, Bristol—An apparatus for heating cylinder-irons or heaters to be used for pressing the seams of garments, finishing of hats, or other purposes for which heated-irons are ordinarily used.

1802. Alfred V. Newton, Chancery Lane—An improved process and improved machinery for obtaining fibres from the stalks or leaves of fibre yielding plants.—(Communication from James Mallory and Gelston Sanford, New York, U.S.)

1803. James Trigwell, Terminus Street, Brighton—Improvements in slide valves.

18*th July*, 1861.

1804. Samuel Tawell, Aldermanbury—An improvement in or addition to the selvages of laces and other woven fabrics.

1805. Arthur Elliott, Manchester, Lancashire—Certain improvements in looms for weaving.

1806. Charles West, Derby Street, Parliament Street, Westminster—Improvements in the mode of insulating and covering wire.

1807. Benjamin Johnson, Surrey Place, Kennington Park, William H. Anderson. White Cottage, Stockwell Place, Surrey—Improvements in pianofortes.

1808. Maurice E. Guaymard, Boulevart St. Martin, Paris—Improvements in the manufacture of shirt fronts, collars, and cuffs.

1809. John Tillotson, Bolton, Lancashire—Certain improvements in the manufacture of pawnbroker's duplicate tickets, and in the apparatus connected therewith.

1810. Peter Williams, Salford, and Thomas Parkinson, Bury, Lancashire—Certain improvements in carding engines for carding cotton or other fibrous substances.

1811. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in capstans and windlasses.—(Communication from Louis F. F. David, Paris.)

1812. George Coles, Gresham Street West, James A. Jaques and John A. Fanshawe, Tottenham—Improved apparatus to be used for brushing and dressing cloth.

1813. James A. Jaques and John A Fanshawe, Tottenham—An improved apparatus for a mode of stopping, plugging, or closing inkstands, bottles, and other vessels of capacity.

1814. Jasper W. Rogers, Roberts Town, Kildare, Ireland—An improved mode of building ships and floating batteries, applicable also in part to the construction of fortifications.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from May 25, *to July* 12, 1860.

May	25,	4373	Colin Pullinger, Selsey, Chichester.—"Perpetual Vermin Trap."
"	31,	4374	Joseph P. Oates, Erdington, near Birmingham.—"Improved Piston for Brass Musical Instruments."
June	14,	4375	Edward Peyton and Wm. F. Batho, Bordeley Works, Birmingham.—"Improved Angle Iron."
"	17,	4376	Edward Davies, Higher Walton, near Warrington.—"Davies's Improved Plough."
"	21,	4377	Thomas Turner, Fisher Street, Birmingham.—"Improved Muzzle and Sight-Protector for Rifled Guns."
"	21,	4378	Cottam and Co., 2 Winsley Street, Oxford Street, W.—"Cottam's Noiseless Manger Shackle and Guides for Halter Rein."
"	27,	4379	J. G. B. Marshall, Rokeby House, Stratford, E.—"Design for Sinks, Surface-gullies, Rain-spouts, and Closets, and their connections to Drains."
"	27,	4380	John B. Dancer, Cross Street, Manchester.—"Improved form of Prism for Binocular or Stereoscopic Microscopes, Telescopes, and Cameras."
July	2,	4381	Thos. H. Toms, Staining-lane, City, E.C.—"The Elcho Scarf."
"	6,	4382	Easterbrook and Allcard, Albert Works, Sheffield.—"Three-Die Stock."
"	8,	4383	Thos. Perry and Son, Bilston.—"Feeding Trough for Sheep and other Animals."
"	8,	4384	Thos. B. Wilkins, Great Charles Street, Birmingham.—"A Clasp or Buckle."
"	11,	4385	Lord Elcho, M.P., 21 St. James's Place, S.W.—"The Elcho Firing Screen."
"	12,	4386	Joseph Downing. 102½ Irving Street. Birmingham.—"A Sash Fastener."

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

VI.

It has been said, that whenever a generally felt want exists, means will be discovered for meeting it; and although even proverbs require to be received "with a reservation," there seems to be less reason than usual to exercise the precaution in respect to the saying thus quoted. The history of the recent progress of civilized nations furnishes indeed striking illustrations of the strange law, by which, when men's minds are energetically turned towards the discovery of means for satisfying a temporary requirement of society, inventors rise up from unexpected quarters to satisfy it. A century ago it was felt that some artificial source of power was needed, because the natural forces of wind and water were no longer sufficient to perform the duty required by the manufacturing interests of the country, and a mathematical instrument maker was led to study and to apply the hitherto unused elastic properties of steam. Just as Watt met the requirement thus referred to, did Brindley, Telford, Rennie, Stephenson, Rowland Hill, Cooke and Wheatstone, in their turns, meet the continually increasing demands of society for improvement in the means of travelling, of transport, and of interchange of thought; and, in matters of detail, just so did Cort, Mushet, and Neilson, improve the arts of metallurgy, in so far as they bore upon the supply of the all essential material, iron. At the present day, a similar demand for further improvement in the manner of manufacturing iron seems to exist; and whether we consider the requirements of society for war or for peace, we find that the call for a description of metal combining the strength and the homogeneousness of steel, with the low price of cast iron, is to be heard on all sides. Steel rails are becoming necessary to allow railways to carry on successfully their continually increasing goods traffic. Steel plates are becoming necessary for ships of the size modern commerce seems to require; and steel guns are necessary to propel the huge elongated shot used in the most recently devised forms of artillery. Engineers and mechanicians are thus anxiously expecting some new change in the processes for the manufacture of iron and steel, and Sir Wm. Armstrong did but express the public feeling on this subject when he urged it upon the consideration of the Society of Mechanical Engineers. Unfortunately the science of war (the science of slaughter and devastation) seems to be the one most likely to derive the first benefit from this new phase of man's intellectual activity; but it has hitherto proved that the very discoveries, by means of which the worst passions of our race have been furnished with new modes of exhibition, have in the end been appropriated with even greater success to the arts of peace. The efforts of our metallurgists to supply steel guns and steel armour plates will thus, no doubt in their turn, advance the real interests of society by placing at the disposal of the workers a material such as is required by the destroyers; and therefore—if for no other reason—the efforts of the men who are now striving to improve the manufacture of iron, for whatsoever purpose, must be watched by society in general with intense interest.

The efforts of the cotton manufacturers, to relieve themselves from their state, if not of dependence, at least of reliance, upon the supply of long staple cotton from the Confederate states of America, may be regarded in the same light as those which are now being made by the iron masters; and the skill of inventors is appealed to with as much feverish anxiety in the one case, as in the other. Hitherto no fresh sources of supply of the best staple of cotton have been discovered, and when the stocks in hand shall have been exhausted, there seems to be every probability that if the present insane contest raging in North America should continue for any length of time, many of the factories of Lancashire and of Scotland, must suspend work. The history of the recent introduction of jute instead of hemp, it is true, inspires hope that shortly some material may be discovered which would dispense with the use of long stapled cotton, even if new sources of supply should not be opened up; but the subject is essentially one which must inspire anxiety, not only to millowners, but even to politicians; for the proportions of English, French, German, and Swiss workmen, who depend for their existence upon the prosperity of the cotton trade, are frightful to contemplate. How bitterly are we Englishmen just now expiating the carelessness with which we have so long treated the resources of our Indian Empire—how earnestly should we now strive to retrace our steps!

Whilst thus dwelling upon the wants, and upon the progresses of the age, we cannot refrain from directing the attention of our manufacturing classes to the state of industrial activity prevailing in the Westphalian provinces of Prussia, especially in the valley of the lower Rhine, and of the Rhür. Of late years, great efforts have been made by the Prussian Government to develop the mining and manufacturing interests of that part of Germany; and coal, iron, lead, and zinc mines have been opened in great numbers, on a large scale, and with most brilliant success. Manufactories, furnaces, mills, of all descriptions, are rising in every direction, and the patient energy of the German race, combined with their keen perception of æsthetical science, bid fair soon to place the workmen of this part of Europe in the foremost ranks of their fellows. Even now, our manufacturers would do well to take lessons from many of their rivals of Westphalia; and they may depend upon it that, unless a better feeling for art be introduced into many of our branches of production, than now prevails, England will soon loose her pre-eminence as a manufacturing nation. A position, such as she now occupies, is only to be maintained by continuous effort; and the number of competitors for the proud distinction is continually increasing. Perhaps the most effectual way of guarding against the consequences of the class of rivalry thus referred to, is to study carefully the genius of the people who are likely to call it into existence; and it is for this reason that we go a little out of our way to urge our manufacturers to examine carefully the conditions of the industrial operations in the Rhenish provinces. The approaching exhibition at Florence might also be made to furnish lessons of inestimable value; for now that the mighty intellect of Italy is enabled to exert itself freely, she must soon resume her position amongst the leading nations of the world.

With the commencement of the sporting season, and the emigration of "horse-breakers" from the capital, the various peripatetic societies have commenced their series of banquets, lectures, collections of cooked statistics, and mutual congratulations. No doubt these occasional gatherings do good, if it were only on the score of their collecting together men who are engaged in any great undertaking, such as the advancement of physical, or of social, science; but the public requires to be reminded that the leaders of these societies are very apt to degenerate into cliques, and that the leaders of cliques are rarely men who hesitate to sacrifice truth to what they believe to be the interests of the causes they espouse. This is especially true with respect to the Association for the Promotion of Social Science; which seems, from Lord Brougham's statement at Dublin, to have fallen under the mischief-working hands of Mr Chadwick. Any one who has read the garbled documents published by this Association must long since have been aware that this was the case; but it is now acknowledged publicly to be so, and it is to be hoped that the public will for the future regard the publications of the Association with the suspicion which ought always to attend the productions of an advocate so bold and uncompromising as that gentleman has proved himself to be. The necessity for our addressing this caution to our readers seems, indeed, to have lately received a very singular collateral illustration in the reports of the Education Commissioners, whose productions are singularly like those which were formerly issued by Mr Chadwick for the Poor Law Board. The Commissioners, in fact, apparently with the motive of proving the necessity for the continuance of their own functions, have thought proper publicly to enter into a contest with the leaders of the ragged school movement; and some of them have not hesitated to utter sweeping accusations against the morality of our labouring population. In both cases, they have been convicted of wilful untruth, and have met with public contradiction and reproof. Unfortunately, their statements are circulated "by authority;" the contradictions have to work their way how they may: the former are read and quoted by foreigners as well as by natives; the latter are only read by parties directly interested. The consequence is, that false notions on subjects of great social importance are diffused, and attention is often diverted from the real evils to which remedies might be found, in order to be wasted on imaginary evils. No doubt, truth is heard in the end, in all these cases; but the interests of a generation are thus often imperilled; and it is precisely because the Association for the Promotion of Social Science is very powerful, as to the direction it may give to the efforts of philanthropists to improve the conditions of the labouring classes, that it has appeared to us that we were bound to call attention to the dangerous influence to which the Association itself is exposed. The conditions of our poorer brethren are, indeed, such as to require the most serious attention of all who are interested in the well-being of society; for even during the recent period of prosperity wherewith we have been favoured, nearly one-sixth of our population has been in occasional receipt of parochial relief, and one-seventeenth has been in the receipt of permanent charity. Surely these things ought not to be; and however we may superexcite the energy of our inventors, however much the splendour of our arts may increase, there can be little security for a nation presenting so vast an amount of misery and suffering as are implied in those simple figures. There is no need to exaggerate the pictures which may be drawn from the simple annals of the poor. Exaggeration may, however, offend and disgust, or at least mislead those who are willing to espouse the good cause; it should therefore at once be guarded against.

On several recent occasions we have called attention to the numerous and fearful accidents which appear to be inevitable in the working of coal; and very recently another misfortune of this class has been recorded in the workings of the Summerlee Mines, of the West of Scotland. In this case the draught of the upcast shaft was produced, as usual, by means of an open fire; and the wood bratticing of the shaft had been rendered so inflammable by its exposure to the heat from the fire, that upon the application of a very slight additional heat, it burst at once into a fierce, uncontrollable blaze. About eleven men were victims of this accident, and it must be regarded as a merciful interposition of Providence that the number was limited even to that fearful proportion. But the question immediately rises, whether there had been any necessity for the existence of the conditions under which the accident occurred. Why should a wood bratticing have been retained in an upcast shaft? This is not the first instance of such wood-work being burnt, and the past experience of the tunnel in Switzerland (wherein the lining and bratticing of the shaft were burnt, and gave rise to a collapse of the sides, closing the entrance to the tunnel heading for not less than three weeks) ought to have taught the managers of this mine that no combustible materials ought to be used in situations exposed, ever so distantly, to the direct action of fire. But a more important question still remains, viz.—Why was the system of creating an upward draught by open fires adopted here, instead of the system of ventilation by means of forcing the air through the mine? Speaking as we do from a distance, it would be ridiculous to pass any very decided opinions on the subject; but we cannot refrain from expressing the hope that a very stringent examination, by competent authorities, may be made into all the circumstances which have cost the lives of so many of our fellow creatures. It is to be feared that the Government supervision of mines has hitherto produced little improvement in the conditions of their working, so far as immunity from accidents to life or limb is concerned, to the miners themselves.

Whilst the word Government is before us, it may be worth while to notice that the inveterate tendency of our rulers to make political capital out of industrial enterprise seems to be as rife as ever; and that, unless the tax payers make a vigorous effort, the Galway Mail Packet Contract will be renewed. The manner in which the Peninsular and Oriental Company has obtained, and carried out, the contract for the conveyance of the Australian mails, has not tended much to inspire confidence in any of these transactions; and, indeed, the assistance rendered to this last named powerful company may be considered to have prevented rivals from coming into the field of competition, and thus to have retarded the development of steam navigation between the home country, and its thriving colony. There is no branch of the public service which requires more vigilant supervision than this particular one of the deep sea service, by steamers under contract with the post-office; for the interests of commerce are indissolubly connected with the unshackled progress of steam navigation, and every unjust preference is but an indirect obstacle to the normal development of the trade. The experiment which has been worked out, so successfully from a technical point of view, by the shareholders of the Great Eastern, seems to us to have merited at least as much encouragement from the state, as the noisily paraded Galway scheme has done; yet, as the one can command small party influence it is passed over, whilst "the sweet voices" of the other are to be propitiated! Passing, however, from this, it is worthy of congratulation and remark, that in the last year the outward passages from London to Boston, have been effected on the average in 13 days, 19 hours, and 5 minutes; and the inward passages in 11 days, 10 hours, and 33 minutes. Twenty years ago the averages were 16 days, and 13½ days, nearly, and thus modern science and industry seem really about "to annihilate time and space," as the enthusiastic statesman said. Before leaving this subject of Steam Navigation, we are again unfortunately obliged to record the frequency of the accidents it appears to involve, and this is the more extraordinary from the fact that the accidents occur in the greatest numbers to vessels navigating well known, well buoyed, and well lighted seas. The fair inference from such facts as the recent losses of steam ships employed in the Baltic trade especially, would seem to be, that the education of the officers of our commercial marine is yet very far from being such as to ensure their competency to discharge the duties they undertake. Perhaps the existing very unsatisfactory system of marine insurance may contribute to—at least it does not discourage—the recklessness of our sailors; and on this account, as well as upon some others, to which we may have occasion to return, it appears to be desirable that public attention should be frequently recalled to the frequency of sea accidents.

As we do not hesitate to express openly our opinion when it is unfavourable to the acts of the Government, it is but fair to mention one instance in which the present administration has adopted a very wise and prudent resolution. It has been determined that in future iron clad vessels shall not be constructed in the national arsenals; and as "the fleet of the future" must forcedly be of iron, an effectual stop will thus be put to the waste and peculation of the dock-yard system. The resources of private ship-builders are henceforth to be alone depended upon; and thus there is hope that the national marine of this essentially sea-faring kingdom may advance *pari passu* with its commercial marine. For instance, it is hardly conceivable that any private ship-builder would have committed the blunder of putting into the Warrior the heavy masts which now disfigure that vessel, and which are so likely to prove worse than useless should she ever be engaged at close quarters. In the commercial marine it has long been an axiom that steamers should not carry much top hamper; in the navy, the practice of masting those vessels, as if they were to trust to their sails alone, seems still to prevail. Breaking through routine in the manner of steam-ship building, will no doubt eventually lead to changes in their design.

The returns of the mineral productions of the United Kingdom during 1860, have lately been published by Mr Hunt, the Keeper of our Mining Records, and singularly important are the results they indicate. It appears that the total value of the minerals raised in 1860 was not less than £26,404.459, against a corresponding value, in 1859, of £24,266,526, or the increase has been £2,177,933 upon the previous year's workings; and it is to be observed that these figures do not comprise the production of salt, or of coal, of stone, or of clay, which must represent a value even greater than the one above quoted; the estimated value of the coal raised in 1860 was, indeed, not less than £20,010,674. The metals which are obtained from our indigenous minerals are, moreover, precisely those which are of the greatest value in industrial operations; and it is satisfactory to observe that the iron ores raised in 1860 were estimated to have been of the value of £2,466,929, and the pig-iron made from them is stated to have been 3,826,752 tons, of a value of £12,703,950. Copper, lead, tin, silver, and zinc, with a few of the rarer metals, such as antimony, arsenic, manganese, nickel, &c., complete the list of our productions; but we cannot refrain, even whilst acknowledging the obligations of practical observers to Mr Hunt, for the valuable information he has already given, from expressing our regret that he should not have recorded at the same time the statistics of the manufacture of sulphur, soda, phosphate of lime, glass, china, stoneware, and of the other branches of trade so closely connected with the applied arts of metallurgy. Some curious and useful information might also have been given, with respect to the extraction and conversion of the mineral oils; but, imperfect though Mr Hunt's tables may thus be, they are still of great value, and highly creditable to his skill, and to his patient research.

The commission for the embankment of the Thames has issued its report; and, strange to say, the public, whether professional or otherwise, has received it with satisfaction. Substantially, the course recommended by the commissioners consists in the reclamation of a large surface of land on the concave or Middlesex bank of the river, and in the construction of a broad roadway from Blackfriars to Westminster bridges. To us it seems that the great objection to the scheme consists in its partial character, and that its effects will simply be to endanger the existing structures across, or upon the sides of, the stream, without effectually dealing with the conditions of its flow. The Thames requires, in fact, to be regularized in its course, from its very outburst to its embouchure; and every thing which is done to its banks should have reference to some such general plan. The story of the river improvements effected in the Clyde, Dee, Ribble, Tyne, Seine, and Rhine, should not be lost upon our rulers; nor should the ruin of Blackfriars and of Westminster Bridges fail to read its lesson. Be this as it may, the embankment of the north shore of the Thames now proposed, will be a step in the right direction. The public must, however, be prepared to find that in undertaking this work, it is only at the beginning of the end; and that the estimates hitherto presented, of the probable cost, will be very far indeed from covering the outlay which eventually will be rendered necessary, before the Thames can be made to render all the services of which it is capable, and before some of its most crying evils can be remedied.

There has been lately rather a lull amongst inventors, and the only project which has been brought prominently before the public, since the date of our last publication, has been the attempt to improve the illuminating power of coal gas, by the introduction of an additional quantity of napthaline at the burner. An experiment upon the practical results of this system has lately been made, on a sufficiently large scale, by Mr Heywood, the Surveyor of the City of London; and he reports that, by a small additional outlay for the naptha, the illuminating powers of the gas are nearly doubled. Mr Heywood is an extremely able, and, what is far better, an extremely conscientious observer; every opinion expressed by him must, therefore, be received with confidence and respect; but at the same time that we thus admit that there may be reasons for believing that the addition of some of the hydro-carbons to the gas, immediately before their combustion, may increase the brilliance of the flames, we must be allowed to express our doubts as to the applicability of any such system to the lighting of a large town. The simplicity of a public service is the first condition of its success; and the mere complication of the mode of napthalizing the public lights would, at all times, be sufficient to render it inapplicable for municipal purposes. Experience has already been obtained in this particular matter; and the failure of all previous attempts to increase the illuminating power of gas, by the local introduction of the richer hydro carbons, ought at least to cause the public authorities to hesitate before they attempt to adopt any of the new methods of effecting the same object, whatever theoretical advantage may be promised by them.

Two deaths have recently occurred in London from the explosion of gases arising from oil which had been purchased as paraffin oil. Our readers are aware that the real paraffin oil is manufactured at the works near Bathgate, in Scotland, from the Boghead coal. The demand for this oil has increased enormously of late years, and consequently, quantities of spurious paraffin oil have appeared in the market. It appears from the evidence taken before the Coroner on the Inquests, held in the cases of these deaths, that the oil had been purchased from a retailer, calling himself a dealer in paraffin oil, and it appeared that this man was in the habit of purchasing his oil, as well from the Paraffin Light Company who deal solely in the patented article, as from others who term their oil in selling it paraffin oil, but who take care to invoice it under the name of mineral oil. Dr Odling, F.R.S., gave evidence at the inquest that the oil which had caused the two deaths was not paraffin oil, but probably a spurious petroleum oil. He also performed a series of experiments which clearly showed that the true paraffin oil would not give off explosive vapours at ordinary temperatures, but that the spurious article would do so; and also that a lighted match would set the explosive oil in a sheet of flame, whilst in the case of the true paraffin oil the application of a match simply acted as a wick. A verdict was eventually given that the deaths were caused by an explosion of the vapour of a certain substance "called paraffin oil," but which was not the paraffin oil sold by the Paraffin Light Company. It therefore behoves the public to see that their purchases are made from respectable dealers, who only sell the true article; and, to use the words of a well-known advertisement paraphrased, "When they ask for paraffin oil, to see that they get it."

INDIAN RAILWAYS.

As we have always felt a lively interest in the progress of railways over our Indian territories, being convinced that they are one of the chief means for ensuring the full benefit of that vast country to the British nation, we have much pleasure in announcing that one of the projected lines has now been completed, and is actually at work. This is the Scinde Railway, a single line, 110 miles in length, which was commenced on the 29th April, 1858, and was opened on the 13th of last May. The two termini are at Kurrachee, a town on the Indian Ocean, lat. 25 N., and at Kotree, on the river Indus, a few miles from Hydrabad. There are four intermediate stations, and in the neighbourhood of Kurrachee there is a short branch to an arm of the Indus. The largest engineering works on the line are two viaducts. The Mulleer viaduct is composed of Warren's patent iron girders, of 80 feet span, resting on stone piers, and is 1860 feet in length. The Bahran viaduct is built of hard white stone found on the spot. It has thirty arches of 45 feet span, and a length of 1782 feet. The latter has been executed by native contractors, chiefly natives of Cutch, a neighbouring district, and it is said to be a very fine piece of masonry. The native population is quite willing to take advantage of this railway, and are sending goods by it in such quantities that its present resources are already taxed to the utmost. One firm of native traders has offered to enter into an arrangement for the conveyance of 140 tons a day. The total expenditure in forming the line, in building stations, and on rolling stock, will be about £1,500,000, and in respect of this sum the company has a guarantee for the payment of 5 per cent. interest from the government. Fully to understand the importance of the Scinde Railway, it must be stated that the same company proposes to navigate the Indus for 520 miles above Kotree, the inland terminus of the railway, by means of a steam flotilla. The actual steaming distance is more than 800 miles. A model steamer, the Stanley, was sent out last year, and has been placed upon the river. The result of the trials was highly favourable, and two passenger steamers have since been launched, each capable of carrying 36 first-class passengers, and 100 tons of cargo, besides two flats each carrying 150 tons. Passenger flats fitted for troop accommodation have also been launched, and several cargo barges have been finished. On the Indus, in the neighbourhood of the town of Mooltan, there commences the Punjaub line of railway, now advancing towards completion, and connecting the cities of Lahore and Umri Osir with the navigable part of the Indus. This railway is about 300 miles in length. Thus by means of the two lines of railway, and the intermediate steam navigation, the produce of the country bordering upon the sources of the various streams that unite to form the Indus, will be brought down to the coast. As to the other railways of India, eight in number, we are sorry to find, from a perusal of the report of the Secretary, Railway Department, India Office, that only 208 miles of railway were opened for traffic during the year 1860 on four great lines. It is stated, however, that this addition to the number of miles completed does not present a correct measure of the progress which has been made generally, and that, owing to the vigorous prosecution of works along the lines, a considerable increase of open way is to be immediately expected. In point of fact, during the first half of the present year, 211 additional miles have been opened. Altogether, 1063 miles are now open for traffic, a much smaller number than ought to have been executed during the time. The extent of line now in course of execution is 2932½ miles, of which 1353½ miles will probably be opened during the present year; and it is expected that in 1862 nearly all the remaining portion will be finished, including the great trunk line from Calcutta to Delhi; but there is some risk of delay from the formidable nature of some of the works. For instance, on the East Indian Railway, there is a tunnel of 900 feet, which has to penetrate for two-thirds of its length through clay slate, and for the remaining distance through quartz rock of such hardness that the progress is extremely slow. The cost will amount to the sum of £60,000. It is somewhat annoying to learn from high authority that it was not at all necessary to undertake it; at any rate, as the only result will be the saving of three miles of line, the expense and delay occasioned by the tunnel are clearly not outweighed by so small a saving of distance. On the same line, there is an immense iron bridge across the Soane, consisting of 27 lattice spans, of 150 feet each. With the abutments, the works extend over nearly a mile. Nearly eighteen months will yet be consumed before this bridge is completed. The chief cause of the slow progress here arises from having to sink three wells, of eighteen feet diameter and thirty feet in depth, for the foundations of each pier. This bridge will cost the enormous sum of £350,000. Another great work on the same line is the Karumnassa Bridge, which is to consist of 13 arches of 40 feet span, and this has probably been arched in before now. The expense of these works, and of others, has made a heavy increase on the estimated cost of the line, which was originally put down at £12,000 a mile, but it is now believed that it will exceed £16,000 a mile. On the Great Indian Peninsula Railway, there are stupendous works on the Bhore Ghat and Thul Ghat inclines. The first of these is rather more than fifteen miles long, and the elevation to be surmounted by it is 1831 feet. The average gradient is 1 in 48—the steepest parts having a gradient of 1 in 37. There are no fewer than twelve tunnels upon it, the total length of which is 2535 yards, and probably short additional tunnels will be substituted for some of the cuttings. There are also here eight viaducts, with forty arches, the spans of which range from thirty to fifty feet, and eighteen bridges, of spans varying from seven to thirty feet. The cost of this incline is estimated at £46,000 per mile. The chief engineer has reported of it that, although original or peculiar conceptions have not been sought for on their own account, the works are of such a unique character that both casual and professional observers will view them with especial interest. The rails of this incline were made on an entirely new specification, to suit the heavy engines which will be employed. They weigh 85 lbs. per lineal yard, and four-fifths of them are 25 feet long.

The Thul Ghat incline is rather more than nine miles long, and its altitude is 972 feet. The average gradient is one in 56—the severest being 1 in 37. There are thirteen tunnels of an aggregate length of 2652 yards; six viaducts, measuring 741 yards; fifteen bridges with spans varying from seven to thirty feet; and 62 culverts. The estimated cost is about £45,000 per mile. One of the viaducts, that over the Ehegaum ravine, will have the level of the way 188 feet above the surface of the ground, and twenty feet have been excavated in order to obtain good foundations. This is said to be the highest viaduct yet designed in India. The iron girders are to be on Warren's principle, 150 feet in span from end to end, and each weighing about 32 tons. To prevent damage to these girders from lateral motion whilst being lifted through 200 feet, arrangements have been made for hoisting them in pairs, so that they may be stiffened by those parts which will connect and steady them when the permanent road is laid. For this purpose, a recess, eight feet six inches wide and four feet deep, was required to be made on each side of the piers, from the surface of the ground to the bed of the girders. The plan of pier adopted is a rectangular one, fifteen feet six inches thick, with two counterforts at each corner of the recess. In this way, not only has that part of the pier which would have been weakened by the recesses been strengthened, but the stability of the whole structure has been increased by widening its base. It is intended to employ screws as the power for elevating the girders, and crabs for securing them against any accidents in the process. The screw will be placed upon the top of the pier, and immediately over the recess. Strong cross links will be suspended from it, each several feet long, down to the top table of the girders. As the girders ascend they will be propped from stage to stage, and the links successively disconnected as the girders rise in pairs towards their bed. Both of these inclines have a reversing station, where the engine will be turned, and where, as the tail will become the head, it will appear to retrograde as it leaves the station. The object in view was to increase the length of the base, in order that the gradient of the incline might be flattened, and a higher level attained. The incline is thus prolonged by nearly the difference between the length of the two sides of an acute angled triangle and that of its base. The principle involved seems to be the same as that of the American zigzag mode of laying out a mountain railway ascent.

Of the Bombay and Baroda railway, 173 miles have been opened for traffic, but under disadvantageous circumstances, as two of the principal towns which it was designed to connect lie on the opposite sides of the rivers. Intelligence, however, has arrived announcing that the last girder has been erected over the Nerbudda, one of these rivers, the viaduct being 3700 feet in length. The Guicowar of Baroda had undertaken to make a tramway 22 miles long from one of the company's stations into a cotton-growing district. This will be an important feeder to the line. It is to be hoped that this example will be followed by more of the native authorities.

One undertaking, the Oude Railway Company, has been postponed, and its operations entirely suspended. Upwards of £12,000 had been expended on surveys, but the amount has been obtained back from government, who have taken possession of the plans and drawings which will thus be available at a more convenient season. The prosecution of certain portions of three of the great schemes has also been suspended, in consequence of the difficulty encountered in raising the necessary funds. The length of the lines thus postponed is 650 miles.

The total cost of the lines now in progress is estimated at nearly 56 millions sterling. The amount of railway materials despatched to India from this country in 1860 was 234,710 tons, value £2,140,703.

AUTOMATIC COFFEE ROASTER,

By Mr Robert Harper, of Melbourne, Victoria.

Illustrated by Plate 278.

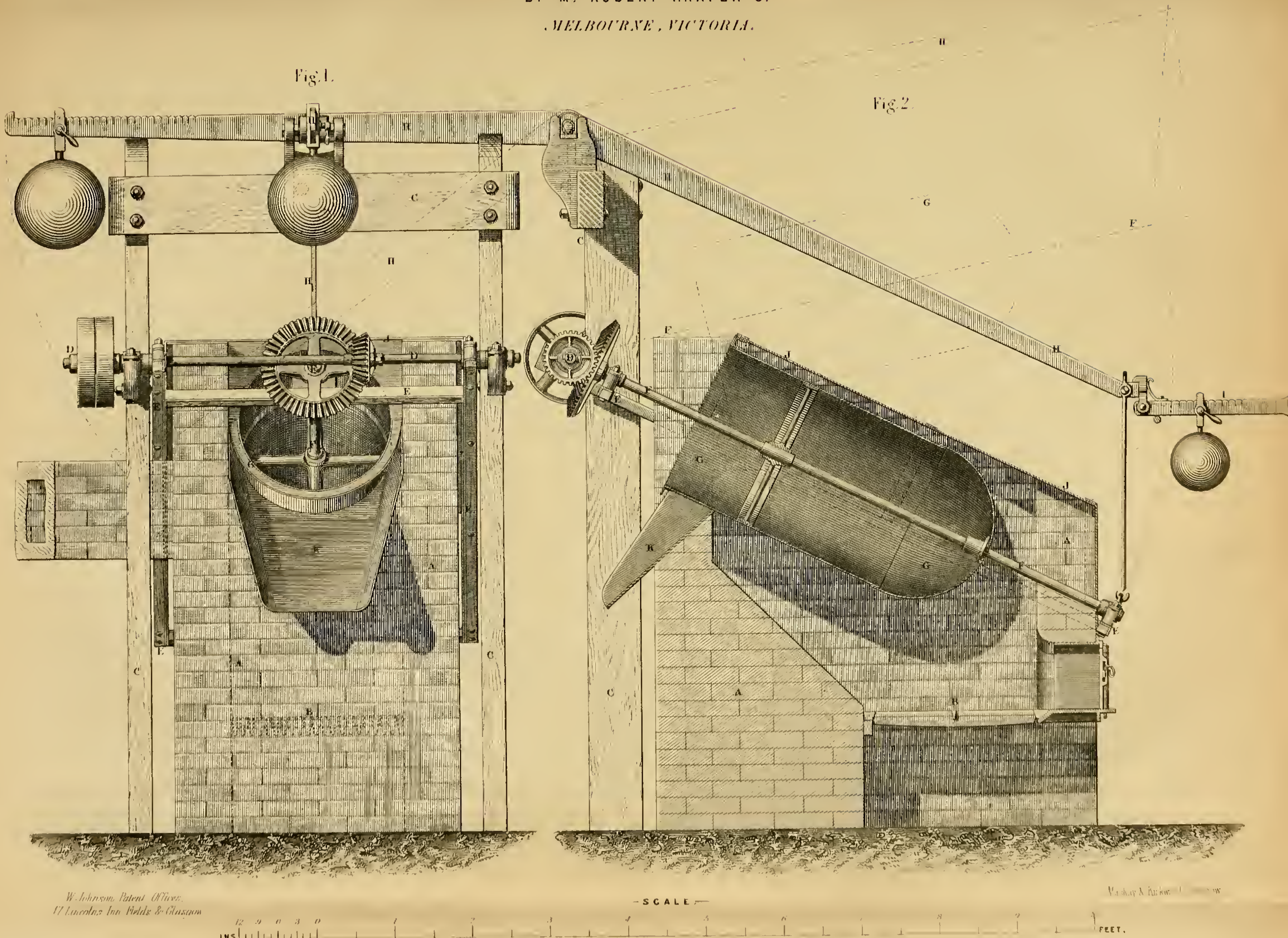
This ingenious automatic apparatus for roasting or drying seeds, roots, or other vegetable produce, has been recently patented in this country by Mr J. H. Johnson, of London and Glasgow, and is a communication to him from Mr Robert Harper, of Melbourne.

In roasting coffee the general practice has been to roast it in close vessels, and the moisture evolved in the operation then passes away

AUTOMATIC COFFEE ROASTER,

BY MR ROBERT HARPER OF

MELBOURNE, VICTORIA.



W. Johnson, Patent Offices,
17 Lincoln's Inn Fields & Glasgow

Mackay & Kirkw. [illegible]

through holes perforated in such vessels in which the coffee is roasted, and is therefore subjected to the injurious influence of watery vapours. Another inconvenience in the use of close vessels is that they have constantly to be opened to ascertain the condition, and the coffee does not become roasted evenly throughout the mass, owing to the fire not acting equally upon the length of the cylinder. This invention is intended to obviate these inconveniences, and it consists, First—In roasting the coffee in cylindrical or other shaped vessels open at the front end, set at an angle, and revolving upon an axis by which the vapour, as it arises from the coffee in the process of roasting, immediately escapes, and the whole of the berries, owing to the cylinder being constantly kept in motion from one end to the other, become equally affected by the heat, and are in consequence evenly roasted throughout.

The vessel in which the coffee is roasted is made to deliver itself of the coffee when it has been roasted to the proper degree. It is well known that coffee contains a certain amount of moisture, which it is necessary to drive off before it is properly roasted. This quantity varies according to the nature of the berry; thus, with plantation coffee it is one-sixth. The second part of this invention consists in so arranging and adjusting the vessel, in which the coffee is placed to be roasted, that as the moisture is drawn off and the coffee roasted, the decreased weight acts against the cylinder and causes the lower end of it to rise up, so that the coffee is delivered in front into any suitable receiver. Thus, if one hundred pounds of plantation coffee are put into this cylinder, and the moisture to be drawn off is one-sixth, the cylinder will be kept in its working position by a pressure of about seventeen pounds; then when the moisture to that extent is drawn off, the lower end will rise up and the coffee will be delivered into the receiver below, the rotary motion being continued; thus the operation will be carried on without the attention of the workmen after the coffee has once been placed in the vessels.

Fig., 1, plate 278, is an end elevation of the apparatus, as arranged, for roasting coffee, and fig. 2, is a longitudinal elevation partially in section. The brick-work, A, is built to form the heating furnace, B, the gaseous products of combustion passing off by the lateral flue, shown in fig. 1; at the front end of the roasting apparatus a timber frame, C, is arranged, the standards of which have bolted to them the bracket bearings of the shaft, D, on one extremity of which is a fast and loose pulley, that derives its motion from a steam engine. The shaft, D, serves to support the front ends of a rectangular frame, E, which is moveable in a vertical plane about its bearings. In the centre of the frame, E, is fitted a shaft, F, which forms the axis of the roasting cylinder, G. This part of the apparatus is formed of sheet iron, lined with wire cloth, which covers the whole of the interior of the cylinder. The cylinder is connected to the shaft, F, by internal radial frames; one end of the cylinder is quite open, and the other is formed to a spherical figure, as shown in fig. 2. The brickwork, A, is built to admit of the cylinder lying at an angle, as shown in the longitudinal view, and openings are formed therein to allow of the cylinder rising upwards and discharging the contents. The lower end of the frame, E, is connected by a link to the oscillating lever, H, which is balanced on knife edges like a scale beam; the bearings of this lever are carried in a bracket piece, which is bolted to the cross beam of the frame, C. At the front end of the lever, H, is a graduated scale and an adjustable counterweight, I. When the cylinder, G, is charged, this weight is adjusted so as to keep the load just in equilibrium. At the backward end of the lever, H, is a small lever, I; the free extremity of this lever is furnished with a hook which catches the end of the lever, H. The pressure which this hook exerts on the lever, H, is regulated by an adjustable weight, which moves to and fro on the lever, I. During the roasting operation rotatory motion is communicated to the cylinder, G, from the shaft, D, on which is a bevel pinion that gears with the bevel wheel on the shaft, F. The cylinder and the upper part of the furnace are enclosed by a light iron cover, J, which is connected to the cylinder at the upper end, and rests on the brickwork, A, at the lower. This metal plate is attached to and is carried by the side bars of the rectangular frame, E, so that it rises and falls with the ascent and descent of the cylinder. When the cylinder, G, is charged with a given quantity of coffee, the weight on the lever, H, is adjusted to the equilibrium, and the weight on the lever, I, is adjusted to the number of pounds of aqueous vapour to be driven off from the coffee. This being done the cylinder is put in motion, the coffee being meanwhile completely protected from burning by the wire cloth lining. As the moisture in the coffee berries is evaporated, this reduction in the weight causes the front end of the lever to preponderate, and so press with a gradually increasing force against the hook of the lever, I. When the evaporation has reached the predetermined quantity, the lever, H, overcomes the weight of the lever, I, and the cylinder ascends to the position indicated by the dotted lines in fig. 2, so that the contents are at once discharged and carried by the shoot, K, into a suitable receptacle placed beneath it for the purpose. Malt, chicory, and other roots and seeds, may be dried or roasted in a superior manner by this apparatus, which is likely to be very generally adopted.

STEAM HAMMER.

By Mr R. Morrison of Ouseburn, Engineer.

Illustrated by Plate 277.

The following particulars were kindly forwarded to us by Mr Morrison, but were unfortunately too late for publication with the plate.

The two frames which carry the cylinder and hammer bar are cast hollow, 2½ inches thick, and weigh 15½ tons each. The cylinder is 46 inches diameter, and weighs 18 tons. The hammer bar is forged of the very best scrap-iron, in one solid piece, with the piston finished to 18 inches diameter, the piston being forged solid upon it, and 46 inches diameter, with an extreme fall of 8 feet 6 inches. The width between the frames is 16 feet 6 inches, and the height under the arch 11 feet 3 inches. The two handles for working the steam valves are arranged one on each side of the frame, so that the attendant can work the hammer on either side. The pendent lever is the steam handle for regulating the supply of steam, and the horizontal one is the waste water cock handle for discharging the water of condensation from the valve and cylinder. The hammer is perfectly free from any projection on either side, so that there is nothing to come in the way of the forgeman, and he can bring the cranes up close on both sides. To arrive at this, the steam valve, as well as the steam and exhaust pipes, are placed inside the box frame, and the pipes are carried down through the bed plate into a tunnel for that purpose. The exhaust pipes discharge the exhaust steam into a drain, and the steam pipes are conveyed under ground to the boilers.

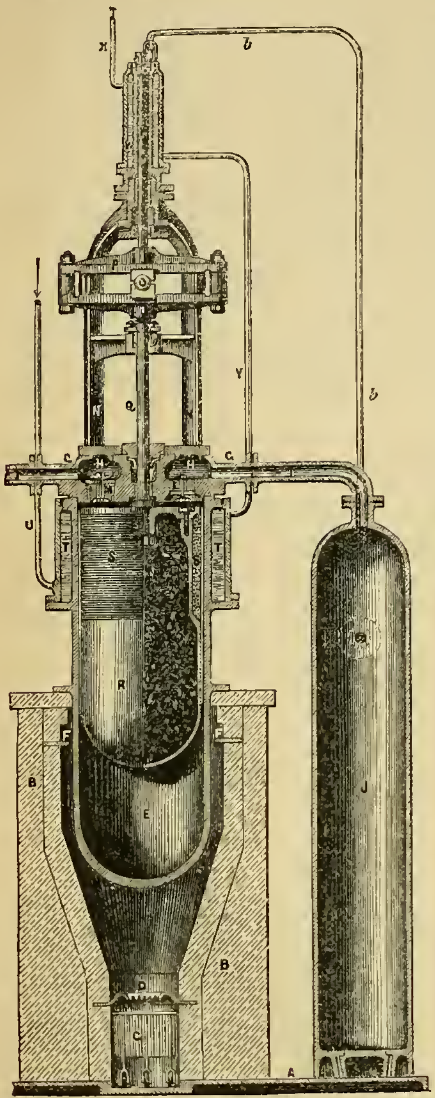
The weight of the hammer is as under:—2 frames, 31 tons; cylinder, covers, glands, valve, and hammer bar and face, 44 tons; above ground together, 75 tons; anvil block, bed plates, and bolts for same below the ground line, 86 tons; total, 161 tons.

The hammer is arranged for the heaviest class of forgings now required by engineers and ship-builders, such as large crank axles and screw frames, and the want of such a hammer has been much felt for some time past, especially since the Government commenced building the large iron-clad ships of war. The want of a steam hammer of sufficient weight and length of stroke has been very much felt. It is well-known that, in the making of the screw frames for the war-ships already built, great difficulty was met with in getting the forgings sound, and several of the heaviest pieces had to be forged twice over, and, in some cases, three times, although made under, we believe, the heaviest hammer then in Britain.

It is presumed that the hammer we have described will be amply sufficient for the heaviest class of forgings at present required, and that it will be soon followed by more powerful machines, as the class of work requires it.

AIR-ENGINES.

This subject has engaged the attention of some of the most eminent engineers in this and other countries, and the ingenious and extensive experiments which have from time to time been performed, in practically employing air in lieu of steam as a motive agent, are highly encouraging. Some years ago an air-engine of considerable dimensions was constructed in this country, and continued daily at work for a period of about five years, and in comparing the number of horses-power exerted with the fuel consumed, the economy appeared greatly in favour of the air-engine. Although some practical difficulties in maintaining the air vessels at the high temperature required were then found, still it is to be hoped that air will yet become a formidable rival to steam, and with this in view, Mr Frederic H. Edwards, Newcastle, has recently patented some improvements, which are illustrated in the subjoined engraving, which is a partially sectional elevation, showing one arrangement of the apparatus suitable for obtaining motive power. Upon a suitable foundation or substructure is laid the sole plate, A, on which is built the furnace, B, formed of brickwork lined with fire bricks. In this arrangement a moveable grate, C, is delineated, as being convenient for experimental purposes; but in ordinary cases the fire bars would be fitted in the usual way. Above the grate, C, is fixed a deflecting plate, D, curved on the under side, and open at the central part. This plate serves to deflect the air which rises up round the grate, C, and bring it in contact with the gaseous matters arising from the burning fuel, so as to facilitate the combustion of the same. Extending downwards into the furnace, B, is a long cylinder or air vessel, E, which is supported by a flange, cast or otherwise formed on its periphery, and resting on the upper part of the furnace, B. The products of combustion from the burning fuel, after heating the lower part of the cylinder, pass along a flue formed by the cast-iron plate, F. This plate acts as a regulator to the draught; it touches the side of the cylinder nearest the chimney, or nearly so, and gradually opens to the side opposite, so as to leave a free passage for the flame around the cylinder, E. This cylinder is formed with a rounded end at the lower part; it extends some distance above the furnace, and has fitted to it the cover, G, which has two valve chambers, H, formed in it; the valve chambers, H, open into laterally diverging pipes, I, one of which communicates with the cylindrical reservoir, J, and the other communicates with a similar reservoir on the other side of the cylinder or heater, E. These reservoirs are by preference formed of cast-iron, an they dare supported on the sole plate, A. The cylinder, J, serves as a reservoir of cold, or nearly cold, high-pressure air, to supply the cylinder of an ordinary engine, so that this reservoir is put in communication with a pipe which conveys the highly-pressed air to the cylinder of the engine to be actuated. The air, after performing its work of actuating the piston of the engine, is conveyed by the exhaust into the lower pressure reservoir (not shown in the engraving) to be used over again in the cylinder, E. The cold air passes into the cylinder, E, through an opening in the cover, G, which is fitted with a valve, L, opening inwards, whilst the recompressed air passes off to the higher-pressure cylinder, J, through the other opening in the cover, which is closed by the valve, M, arranged to open outwards. The higher and lower pressure reservoirs are first charged with air compressed to the requisite pressure by a pneumatic pump worked by hand, by a small steam-engine, or other convenient power, and this compressed air is then transferred from the lower to the higher pressure reservoir by the reciprocatory movement imparted to a plunger arranged within the cylinder, E. In this modification the motion of the plunger is obtained from a small supplementary or donkey engine; but the required motion may be imparted from the engine which is driven by the high pressure air. On the upper part of the cylinder, E, is fixed the vertical framing, N, across which the crank-shaft, O, of the donkey engine extends and gives motion to the cross head, P, to the lower part of which is keyed the rod, Q, of the plunger, R, that passes through a stuffing-box in the cylinder cover. This plunger is formed of iron; it is hollow, and slides easily up and down within the cylinder, E, leaving a small annular space round it free for the passage of the air, which it displaces, and thereby drives past itself from one end of the cylinder, E, to the other alternately. The interior of the plunger is filled with charcoal, or other non-conducting material. The upper part of the plunger is reduced in diameter, and this portion is encased with layers of wire-gauze, S, very fine wire in flocks (like horse-hair in seats), or thin perforated metal, or other good conductor of heat susceptible of rapid change of temperature, and capable of finely dividing the air on its passage. When the plunger is put in motion by the crank-shaft, O, its downward movement displaces the hot air below it, which, rising up the annular space round its sides, encounters the fine wire or gauze, S, and yields its heat to it. The air consequently emerges above the plunger nearly cold, and with its pressure reduced below that of the lower-pressure reservoir, a portion of the air from this reservoir flows in consequence through the valve, L, into the cylinder, E; then by the upward movement of the plunger the air is caused to flow down its sides, where it again permeates the wire or gauze, S, and from it reabsorbs the heat previously abstracted from the ascending hot air, and takes a further portion of heat from the hot surface of the lower part of the cylinder, E. The heat imparted from these sources increases the pressure of the air until the resistance of the valve, M, being overcome, a portion of the cold air still remaining above the plunger flows into the higher-pressure reservoir, J. The cold air so expelled being forced out by the expansion of the portion heated reacting against the bottom of the cylinder, E, for the pressures of the cold air above the plunger and of the hot air below it are necessarily always equal, owing to the free communication existing between them in the annular space between the cylinder, E, and the plunger, R, already described. Instead of allowing the air to flow down the side of the plunger it may, if preferred, be directed through passages in the plunger, or even outside the cylinder altogether, in which case the fine wire would be placed in those passages so as to intercept and divide, and thereby alternately heat and cool the current of air induced by the action of the plunger, which would then require to be more closely fitted to the cylinder. The air thus condensed by its expansive force actuates the piston of a motive-power engine, and after doing this work it escapes by the exhaust pipe to the lower pressure reservoir, and in this way, by means of the differential pressure between the two reservoirs, the engine is actuated. In order to keep the upper part of the cylinder, E, as cool as possible, it is provided with a jacket or annular water space, T, through which cold water is circulated. The water is supplied from a cistern or reservoir arranged above the air-heating apparatus, and is conveyed down to the jacket, T, by the pipe, U. From the jacket, T, the water ascends up through the pipe, V, which enters the jacket, W, arranged on the upper part of the framing, and away by the pipe, X, to the cistern or source of supply. If found necessary, the circulation of the water may be facilitated by means of a force-pump, or other equivalent contrivance. The jacket, W, surrounds the barrel of an air-pump fitted on the upper part of the framing, the plunger of which is keyed to the cross-head, P, from which it derives its motion. At the upper part of the air-pump are arranged the inlet valve, Z, and the outlet valve, *a*, which communicates with the pipe, *b*, that serves to convey the air down to the lower pressure reservoir. The air-pump serves to make up for any leakage that may arise during the working, and the object of surrounding the barrel with a water jacket is to absorb the heat produced by the compression of the air. The position as well as the arrangement of the several details may, however, be greatly varied and modified to suit the particular purpose for which the apparatus is required.



Engines arranged and actuated according to these improvements are applicable to the driving of machinery, the raising and forcing of water, and other generally similar purposes to which steam power is ordinarily applied. For large engines, it is preferred to increase the number of regenerative cylinders rather than largely increase their dimensions, in which case it is not necessary to increase the number of reservoirs also, since any number of cylinders can with advantage transfer the contents of one supply reservoir to a single outlet reservoir, and if acting consecutively, the differential pressure would be subject to less variation than if one cylinder only were used.

THE COLOURING MATTERS DERIVED FROM COAL-TAR.*

Nitrophenylene-diamine, or Nitrazophenylamine.—Dinitr-aniline, when submitted to the action of sulphide of ammonium, changes into this beautiful base, which crystallizes in needles of a red colour somewhat similar in appearance to chromic acid. It dissolves in water, forming a yellow or orange-coloured solution like that of bichromate of potassium. Alcohol and ether dissolve it freely. It is not at all similar to fuchsine in its properties, as it forms salts of yellowish brown or grey colour; whereas fuchsine forms crimson ones.

Picric or Dinitrophenic Acid.—This beautiful acid was discovered as early as 1788, by Hausmann. It may be obtained by the action of heated nitric acid on a great variety of substances; the following are the names of some of them: indigo, aniline, carbolic acid, saligenine, salicylious and salicylic acids, salicin, phlorizin, cumarin, silk, aloes, and various gum resins. It is now prepared for commercial purposes from carbolic acid, and also from certain gum resins. I have prepared it from carbolic acid on the large scale, in the following manner, with success—As strong nitric acid acts very violently when brought in contact with carbolic acid, I have found it best to use an acid having a gravity less than 1·3, so as partially to convert the carbolic acid, and afterwards to boil it in stronger acid to change it into picric acid. On diluting the acid solution the impure picric acid precipitates. To further purify this it should be crystallized from boiling water. When preparing this product for commercial purposes it is advantageous to let all the nitrous fumes formed in its preparation, together with a certain amount of atmospheric air, to pass over a fresh quantity of carbolic acid. This will absorb them, and at the same time be converted into nitro or dinitrophenic acid, and consequently diminish the quantity of nitric acid required for its manufacture. When preparing picric acid from carbolic acid there is always a quantity of a yellow, resinous matter produced, and at times a considerable quantity of oxalic acid. The latter is always produced when the acid which is used to finally convert the carbolic acid is too weak, for then it rapidly decomposes the picric acid, yielding carbonic and oxalic acids. Picric acid, when pure and dry, is of a light primrose-yellow colour, crystallizing in strongly-shining lamina. It possesses an extremely bitter taste, and dissolves in water with a beautiful yellow colour. When digested with protoxide of iron in the cold, it yields a brown amorphous compound, which dissolves in water with a blood-red colour. Picrate of copper is of a beautiful yellowish green colour when in solution. If required for dyeing purposes, it may be prepared by mixing a solution of a picrate with sulphate of copper. Picric acid was introduced as a dye about five or six years since, by MM. Guinon, Marnas, and Bonney, eminent silk dyers of Lyons. Many of the cheap products sold as picric acid are of a brown colour, and consist of impure di- and tri-nitrophenic acids, and sometimes of this crude product and ground turmeric.

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* The substance of a paper read by Mr Perkin, before the Chemical Society. Continued from page 119.

Rosolic Acid—Runge first noticed this substance in 1834, when studying creasote, but it was almost lost sight of until again observed by Dr Hugo Muller, only a short time since. He accidentally observed that when crude phenate of calcium is exposed to a moist, heated atmosphere, as that of an ordinary drying stove, it gradually changes in colour, and assumes a dark red tint. This coloration is owing to the formation of rosolate of calcium. I have lately heard that phenate of sodium undergoes a similar change. Dr Muller prepared rosolic acid from this product in the following manner—The crude rosolate of calcium is first boiled with a solution of carbonate of ammonia. By this means a crimson solution containing the rosolic acid is obtained. This solution is then evaporated nearly to dryness, during which process ammonia is given off, and the crimson-coloured liquid gradually changes to a yellowish red, and at the same time a dark resinous matter separates. This resinous substance is crude rosolic acid. In order to purify it, it is submitted to the following treatment, proposed by Runge—The crude rosolic acid is dissolved in alcohol, and hydrate of calcium added in slight excess. The beautiful crimson solution which is thus formed is agitated for some time with the undissolved portion of the lime, filtered, and the filtrate diluted with water, and lastly, the alcohol distilled off. The residuary rosolate of calcium is then decomposed with just a sufficient quantity of acetic acid, and the whole boiled until every trace of free acetic acid and still adhering alcohol is volatilised. The rosolic acid separates first as a red precipitate, but when heated, cakes together, forming a dark, brittle substance, having a greenish metallic lustre.

It may be still further purified by solution in alcohol, to which a little hydrochloric acid has been added, and precipitation with water. Pure rosolic acid is a dark amorphous substance, possessing the greenish metallic lustre of cantharides. Its powder is of a red, or rather scarlet shade, which, if rubbed with a hard, smooth body, assumes a bright gold-like lustre. In thin layers, rosolic acid presents an orange colour when viewed with transmitted light, but with reflected light a golden metallic appearance. When thrown down from an alcoholic solution with water, it forms a flocculent precipitate of a bright red colour resembling the basic chromate of lead. Concentrated acids, as acetic, hydrochloric and sulphuric, readily dissolve rosolic acid, forming brownish yellow solutions from which water precipitates this acid unchanged. To cold water it imparts a bright yellow colour, and it is more soluble in hot than cold water. Alcohol and ether dissolve rosolic acid with great facility, forming orange or brownish yellow solutions which, on evaporation, leave it in an amorphous state. With ammonia, caustic alkalies, and caustic earths, it forms dark red compounds which dissolve with a magnificent red colour. These compounds are very unstable. No precipitates are formed with aqueous solutions of the rosolates, with the basic acetates of lead, or with any other metallic salt; nor is any carried down by alumina or any other metallic oxide. Dr Muller made two combustions of rosolic acid, which yielded results that agree with the formula $C_{23} H_{22} O_4$. I and Mr Duppa, when investigating some of the derivatives of acetic acid, found that when phenic and bromacetic acids were heated together at 120 centigrade, two products were formed, one possessing all the properties of rosolic acid, while the other had the character of brunolic acid. We also found that a mixture of iodine and carbolic acid when heated with formic, acetic, butyric, or valerianic acids, produce rosolic acid, or a similar substance. A mixture of carbolic acid and iodine did not give a similar result; but a black solid, containing iodine. Rosolic acid has lately been prepared on a large scale, and employed for the purpose of printing muslins. I believe it was a rosolate of magnesium that was employed for this purpose. I do not think it is now used, having been replaced by the more beautiful colouring matter fuchsine. It was fixed by means of albumen.

Azuline.—This substance, which is a beautiful blue dye, has been introduced within the last six months. It was discovered by MM. Guinon, Marnas, and Bonucy, of Lyons, who keep the process for its preparation a secret. It is obtained from coal tar, but from which of its numerous derivatives is not known. This colouring matter is a brittle, uncrystallizable body, possessing a coppery metallic reflection. It is very difficultly soluble in water, but soluble in alcohol, producing a magnificent blue solution, having but a slight tinge of red. With concentrated sulphuric acid it forms a blood-red liquid which, when poured into an excess of water, precipitates the colouring matter unchanged. Dilute acids have no effect upon azuline. Its alcoholic solution, when mixed with an alcoholic solution of hydrate of potassium, also changes to a dull red colour. This, when diluted with water, forms a purple liquid which is gradually restored to its original blue colour by hydrochloric acid. With excess of ammonia the solutions of azuline change to a reddish purple colour. This ammoniacal solution, when treated with sulphide of ammonium, gradually assumes a dull, yellowish-brown colour. Iodine destroys the colour of azuline. In colour it is not quite so fine as chinoline blue, though far superior to Prussian blue.

Application of Coal-tar Colours to the Arts of Dyeing and Calico Printing.—I cannot enter fully into this subject, because, not being a practical dyer or printer, I do not feel sufficiently acquainted with the various operations of the dye-house or print-works to do so. I therefore propose to speak of the different processes employed for dyeing and printing with coal tar colours in general terms only.

Dyeing Silk and Wool.—Silk and wool can be dyed with all the coal-tar colours with the exception of the rosolates, these fibres possessing, in most cases, a remarkable affinity, if I may so speak, for these colouring matters. Many of them, as aniline purple, and violine, are taken from their aqueous solutions so perfectly by these substances that the water in which they have been dissolved is left colourless; in fact, silk and wool take them up so rapidly that one of the great difficulties the dyer has to contend with is to get the fibres dyed evenly.

To Dye Silk with Aniline Purple, Violine, and Roseine.—One process is applicable for dyeing silk with either of these colouring matters, and it is a very simple one. An alcoholic solution of the colouring matter required is to be mixed with about eight times its bulk of hot water previously acidulated with tartaric acid, and then poured into the dye-bath, which consists of cold water slightly acidulated. After being well mixed, the silk is to be worked in it until of the required shade. If a bluer shade than that of the colouring matter is required, a little solution of sulpho-indigotic acid may be added to the dye-bath, or the silk may previously be dyed blue with Prussian blue, or any other blue, and then worked in the dye-bath.

To Dye Silk with Fuchsine, Picric Acid, Chinoline Blue, and Chinoline Violet.—This process is still more simple than the above, as it is simply necessary to work the silk in cold, aqueous solutions of these colouring matters. With fuchsine or picric acid a little acetic acid may be used, but with chinoline colours acids must be avoided. With picric acid a very clear green colour may be obtained by adding a little sulpho-indigotic acid to the dye-bath. I may mention that violine is not of such a fine colour as that produced by aniline purple and indigo blue; and also that roseine is not such a good colour as fuchsine or magenta.

To Dye Silk with Azuline.—The dyeing of silk with this colouring matter is far more difficult than with the preceding, requiring to go through two or three different processes. This difficulty, I believe, arises from the insolubility of azuline in water. The process generally employed is to work the silk in a solution of the colouring matter acidulated with sulphuric acid, and when of a sufficient depth, to raise the temperature of the dye-bath to the boiling point, and work the silk in it again. After this the silk is well rinsed in water until free from acid, and worked in a bath of soap lather. It is then again rinsed and finished in a dilute acid bath.

To Dye Wool with Aniline Purple, Violine, Roseine, Fuchsine, and Chinoline Colours.—This operation is generally conducted at a temperature of 50 or 60 centigrade, and the dye-bath is composed of nothing but a dilute aqueous solution of the colouring matter required. Acids should be avoided, or only a very small quantity used, as the resulting colours are not so fine when they are employed.

Methods of Dyeing Cotton with Coal-tar Colours.—When aniline purple was first introduced, considerable difficulty was experienced in dyeing cotton so as to obtain a colour that would resist the action of soap. Aniline purple is absorbed by vegetable fibres to a certain extent, and very beautiful colours may be obtained by simply working cotton in its aqueous solution; but when thus dyed the colours will not stand the action of soap. I have tried the use of tin and other mordants, but without any satisfactory result.

In 1857 Mr Pullar, of Perth, and myself simultaneously discovered a process by which this colouring matter could be fixed upon vegetable fibres so as to resist the action of soap. This process is based upon the formation of an insoluble compound of the colouring matter with tannin and a metallic base in the fibre. To effect this the cotton has to be soaked in a decoction of sumac, galls, or any other substance rich in tannin, for an hour or two, and then passed into a weak solution of stannate of sodium, and worked in it for about an hour. It is then wrung out, turned in a dilute acid liquor, and then rinsed in water. Cotton thus prepared is of a pale yellow colour, and has a remarkable power of combining with aniline purple.

The above process may be modified: for example, the stannate of sodium may be applied to the cotton before the tannin, and alum may also be used in the place of stannate of sodium. To dye this prepared cotton with aniline purple, it is only necessary to work it in an acidulated solution of the colouring matter; and when thus prepared the cotton will absorb all the colouring matter of the dye-bath, leaving the water perfectly colourless. It has been found that cotton thus prepared can be dyed with any colouring matter that forms insoluble compounds with tannin; therefore it is used for dyeing with roseine, violine, fuchsine, and chinoline colours.

Cotton may also be dyed a very good and fast colour by mordanting it with a basic lead salt, and then working it in hot solution of soap to which aniline purple had been added. Oiled cotton, such as is used for dyeing with madder, is also used in dyeing these colours. Cotton simply oiled, and before mordanted with alum and galls, also combines readily with these colouring matters; but as the colour of the prepared cotton is generally rather yellow, it interferes sometimes with the beauty of the result. Cotton is sometimes coated with albumen, which is coagulated by the action of steam, and the albumen which covers the cotton dyed in the usual manner. I may mention that violine, roseine, fuchsine, and also the chinoline colours, combine with unmordanted vegetable fibres, as well as aniline purple. Picric and rosolic acids are not applicable for dyeing cotton.

Printing Calico with Coal-tar Colours.—The process generally employed for printing with these colouring matters is simply to mix the colouring matters with albumen or lacterine, print the mixture on the fibre, and then to coagulate the albumen or lacterine by the agency of steam. I and Mr Gray, of the Dalmarnoch Print Works, discovered the first process of applying these substances to fabrics in a different manner to the above. It consisted in forming a basic carbonate or an oxide of lead on those parts of the cloth which were to be coloured, and then working the cloth thus prepared in a hot lather containing the colouring matter. Where the cloth was mordanted with the lead compound colouring matter was absorbed; but when unmordanted it was left white, because pure cotton is not dyed with these colouring matters in the presence of soap. This process was intended for the application of aniline purple, for at the period of this discovery the other coal-tar colours were unknown. Colours dyed by this process were very pure, but it had many disadvantages, which have caused it to be disused. Lately the process previously described for dyeing colours upon cotton prepared with tannin has been applied to calico printing. It consists in printing tannin upon the fabric previously prepared with stannate of sodium, and then dyeing it in a hot dilute acid solution of the colouring matter. By this means the parts of the fabric which are covered with tannin are dyed a deep colour, but the other parts are only slightly coloured. These are cleared by means of well-known processes. This method of applying these colouring matters is also modified by printing a compound of the colouring matter required and tannin on the prepared cloth, instead of tannin only, and then steaming the goods.

Method of Applying Aniline Green to Fabrics.—This process is interesting, as being the first example of the production of coal-tar colours on the fabric itself. It was proposed by Professor Calvert. His process is very simple. The design is to be printed on the cloth with a thickened solution of chlorate of potassium, dried, passed through a solution of an aniline salt, again dried, and allowed to hang in a moist atmosphere. In the course of two or three days the colour will be fully developed. The colour thus produced may be changed into a dark blue by the agency of soap or an alkaline liquid. This process is very inexpensive, the amount of aniline required being very small.

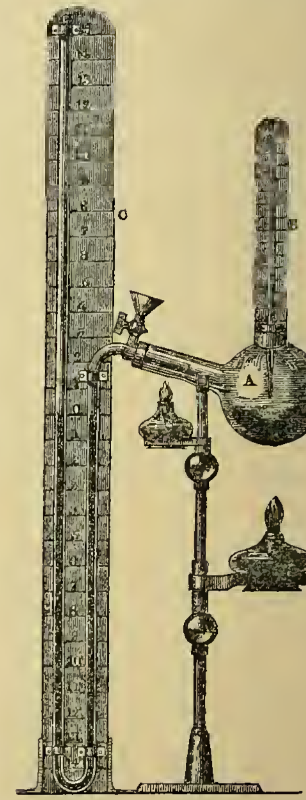
STEAM AND ITS ECONOMY.

VIII.

From the various experiments I have brought under notice in the different papers published in your magazine, it will be apparent that there is a mean point of expansion in the metals, fluids, vapours and gases. It has also been clearly indicated that just in proportion as we exceed this mean point we sacrifice a greater amount of heat without receiving an equivalent to that of the former, and just in proportion as we exceed the point, the waste of heat increases at a much greater ratio. This view of the question by many, I know, will not be admitted, more particularly by those who speak of 1000 lbs. on the square inch; but we think it will first require to be proved that we can get 1000 lbs. on the square inch, before we begin to reason of its economy. It seems clearly indicated by experiment that such a pressure could not be produced, not even the half of it; for we know well that when the vapour of steam is subjected to a very high temperature its elasticity begins to follow a slow rate of expansion, and that, when carried past a given degree, its dynamical energies become suspended, the vapour having undergone a change, this change clearly indicating that the expansion of steam follows a similar law to that of the metals, fluids, vapours, and gases. From this, it would seem evident that it betrays a limited knowledge of the science when we hear men speak and write of such extreme pressures.

By referring to the heat chart in the February number, it will enable us to form an idea of the decrease of expansion and the increase of heat attending it. Do not suppose that I write against the use of high pressed steam; far from it. It is only to these extreme pressures I refer. We have seen many statements of the economy of using those extreme pressures, but these statements have failed to convince men who, from long experience, are capable of judging, and know well that if they gain on the one hand they must lose on the other.

There is another point to be kept in view in the consideration of this important question, that is the different patents that have been taken out for the saving of fuel, which have not been confined simply to the arrangement or construction of the steam-engine, but have extended to the construction and improvement of the steam-boiler, and to those varied boiler arrangements may be traced a greater amount of economy than many of the improvements effected in the steam-engine. From experiments I have made in the expansion of steam, I am not inclined to believe that we gain that amount of power which is generally supposed. I may be referred to diagrams which appear to indicate the power of expansion. The power of the steam engine is generally calculated from these diagrams, but we know, where it has been convenient to test that indicated power by the dynometer, that these diagrams did not represent a true indication of the effective power of the engine; although the diagrams may be useful in indicating the working condition of the engine, and comparing one engine with another, but as a true indication of the effective power they are not to be relied upon.



For the purpose of making a few experiments on the expansion of steam (see annexed engraving), under the tube of the vessel, B, were fixed two spirit lamps, which raised the temperature of the tube to a heat near to that of the steam in the boiler, A, but the instant the steam in the tube was cut off from that in the boiler the mercury in the gauge, C, fell quickly, thus shewing that the expanding steam gave but little resistance. In making those experiments, there was one effect which seemed to be clearly indicated. When the pressure of the steam in the boiler was equal to 10 lbs., and the steam quickly turned on, the mercury, in its first rebound, indicated a pressure equal to $11\frac{1}{2}$ lbs, thus showing that the instantaneous action of the steam produced a gain equal to $1\frac{1}{2}$ pounds. The pressure of the steam in the boiler was then increased to 20 lbs., and the steam was again turned quickly on, the rebound of the mercury equalled 24 lbs., thus indicating from the rebound an increased power equal to four pounds. The pressure of the steam was then increased to 30 lbs., and the instantaneous rebound raised the mercury to from 35 lbs to 36 lbs. From these experiments, it appears that the instantaneous impact or rebound is the great effective force, and the effect of that rebound continues to the end of the stroke. This, so far, explains to us the advantage of combined cylinders in the construction of the steam engine; for it will be evident that the instant the steam is allowed free motion, so that it may rebound instantaneously by this means, a certain amount of power is gained, which is again renewed by the transmission of the steam from the one cylinder to the other, and thus producing a saving of fuel.

We know that it is affirmed by many that, from a single cylinder, if equal in size, the same results might be gained. There are many good reasons to doubt this view of the question. The expansion of steam conveys to our mind the giving out of power; but we know that the steam when expanding is losing power most rapidly. We have been so much accustomed to this view, with the idea of a great saving of fuel which is to be gained by an increased expansion and temperature, that we seem to forget that the power of the steam is contracting while it is expanding; but, as time passes on, we are beginning to learn that the anticipated gain is more an idea than reality. It is very well to be informed that, by certain arrangements, a great saving of fuel is effected, but the first question to be asked is, what power or speed is gained? as the amount of economy may be determined from the answer. The answer may be, nine knots per hour. That we may understand this more clearly, let us suppose the engines of a steamer to be 400 horse power, making twelve knots per hour. By diminishing the consumption of fuel one-fourth, we should lose little more than one knot per hour in the average speed. It would appear from this that we need not be surprised when we hear of a great amount of saving where the speed is not the leading point; there is no difficulty in showing a great saving of fuel where speed is not the consideration. The economy of this question can only be settled by those steamers coming up to a similar speed with them that are considered behind in improvements. Until this be fairly carried out, the question of economy can never be considered fairly settled; and there are many good reasons for believing that the economy of fuel does not rest on the still falling expansion of the steam. The efficiency of the steam is only to be gained by a sharp and immediate action.

When expansion is carried to an extreme point, there must be a greater amount of condensation take place in the cylinders, so much so, that we are informed the cylinders do not require to be lubricated. We think it would be better that they required lubricating, instead of being lubricated by the condensed vapour; for where the cylinder is surrounded by a greater amount of heat without than within, evaporation must be going on, which may impede or repel the piston when ascending or descending, and thus impair the power of the engine. Extreme pressures and expansions may for a time take the lead, but each day is making their term shorter.

In proof of this, let us refer to the experiments made at the expense of the American Government, by their chief engineer, Isherwood, assisted by Zeller, Long, and Stimers, who were appointed to carry out the observations and experiments. The Government steamer selected for this purpose was the "Erie Pa." Each experiment was continued 72 hours, thus giving full time for careful observations. "The water in the boiler was gauged, and the quantity fed in was accurately measured. Every pound of coal fed into the furnaces was carefully weighed; indicator cards were taken, and everything arranged to insure accuracy. The results of seven experiments, cutting off at 11-12ths, 7-10ths, 4-9ths, 3-10ths, 1-4th, 1-6th, 4-45ths, of the stroke, are given in a tabulated form. Five of these were performed with Ormsby bituminous coal, and the other two with anthracite and Brookfield coal. The pressure in the boilers, above the atmosphere was 19·5 lbs. the lowest, 22 lbs. the highest. The quantities of water consumed were 29·942 lbs. per total horse power, cutting off at 11-12ths stroke, 30 881 at 7-10ths, 29·416 at 4-9ths, 30·592 at 3-10ths, 29·841 at 1-4th, 30·715 at 1-6th, 32·044 at 4-45ths. These are important items, demanding careful scrutiny.

The water fed into the boiler was carefully measured in a tank, and it was found that just in proportion as expansion was extended, there was a proportionally greater loss of steam in the cylinder by condensation—a great deal more steam flowed into the cylinder than was accounted for by the indicator. Thus cutting off at 11-12ths of the stroke the loss was 2·91; at 7-10ths, 6·60; at 4-9ths, 18·14; at 3-10ths, 33 07; at 1-4th, 30·84; at 1-6th, 33·66; and at 4-45ths, not less than 37·16 per cent. not accounted for. The conclusion arrived at is, in essence, that so much condensation takes place in the cylinder by the cooling action of expansion, that no economy results from using highly expanded steam. It is true that somewhat more power is developed in the same cylinder by expansion, but by using smaller cylinders proportioned to the power required without expansion, the economy is on the side of non-expansion, both with respect to fuel and the cost of machinery.

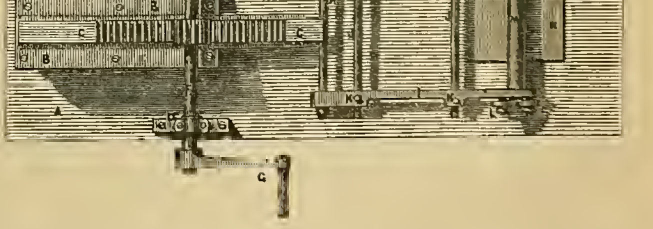
In conjunction with the publication of this report, Engineer Stimers, of the Board, has also published an article on the subject, in the *Journal of the Franklin Institute*, in which he gives the substance of the report, and confesses that he is a convert to the non-expansive practice, as being the most economical. He states that he was taught that the indicator diagram was an exponent of the economy of the engine, and that when the experiments commenced he had little doubt of the result, and believed Mr Isherwood to have been mistaken in his former experiments. It would appear from these experiments that our present method of calculating the power of the steam engine from diagrams is not to be relied upon. This I purpose to examine more particularly in your next.

PAUL CAMERON.

THE APPLICATION OF PHOTOGRAPHY TO THE PRODUCTION OF PRINTING SURFACES.

THE fascinating art of photography has extended its influence almost to every part of the habitable globe. Every civilized member of the human family is, as it were, indebted to the art for its truthful pictures of natural scenery and portraiture. Its development as an agent in the mechanical arts has, however, been slow, and it may be admitted to have disappointed those who formed high expectations of its utility in various branches of manufactures. But we do not despair of seeing its assistance rendered largely available in the production of ornamental designs, and in the extension of decorative art. A highly important application of photography has been recently introduced by Mr A. A. Dalglish, of Glasgow. This gentleman's invention is, we believe, destined to play a very prominent part in the production of designs for the calico printer, and other kindred purposes. Mr Dalglish's improvements comprehend the application or employment of photography for the purpose of putting designs upon rollers, mills, plates, or other surfaces made of steel, copper, wood, or other material, with the object of transferring the design on to, and repeating it on, larger rollers and plates used in the printing of calicoes, paper, or other surfaces; also the printing of the design on the roller, mill, or plate upon the larger roller or plate, with varnish or other material, and printing, embossing, or impressing the design on a varnish coated upon the larger roller or plate; also to the transferring a design or picture to copper, steel, wood, or other material, for copper or steelplate or wood engraving. The means by which this is accomplished are as follows:—The design is photographed in the ordinary way upon glass, paper, or other suitable material, and transferred to the mill, roller, or plate by means of a varnish with which the surface of the mill, roller, or plate is coated. A solution, when requisite, is applied to the surface of the photograph, by means of which the film of the photograph is transferred to the surface of the mill, roller, or plate, when their surfaces are brought into contact. The pattern being transferred upon the mill, roller, or plate, and the varnish being capable of resisting acids, the design is etched or bitten completely or partially thereon by means of an acid; or the ground of the design may be etched or bitten with the acid, and the design left in relief; or instead of being etched or bitten with acid, the design or ground of the design may be engraved, or it may be partially etched or bitten with the acid and finished by engraving. For the printing of the design on the larger roller or plate, the design on the small roller may be filled with a varnish, by means of which the design may be printed on the larger roller or plate. For the printing, embossing, or impressing of the design on the larger roller or plate, it may be coated with a varnish, and the design on the mill, roller, or plate may be printed, embossed, or impressed thereon; or the ground of the design on the mill, roller, or plate may be etched or bitten out or engraved, and printed, embossed, or impressed on the larger roller or plate. The roller or plate may then be immersed in an acid which etches or bites in the usual way. The process may also be carried out by coating the plate or other surface with gutta-percha or other varnish, and afterwards with collodion, and then taking the picture direct in the camera.

For transferring a design or picture to copper, steel, wood, or other material, the same process may be applied as for transferring the design to the mill or roller. In transferring designs, patterns, or pictures to cylindrical dies used in preparing rollers for calico printers, the patentee prefers to use for the transfer process the machine which is represented in the accompanying engraving, which is the plan of a machine



suitable for the purpose. It consists of a base or table, A, on which is fitted the dovetailed guides, B; these are supported a short distance above the base on short columns. The groove formed by the guides, B, has fitted in it the longitudinally traversing rack, C. Outside the guides, B, are fitted the pedestal bearings, D, in which is carried the small shaft or transverse spindle, F, having fast to it a pinion. The shaft, F, is put in motion by means of the winch handle, G, so as to traverse the rack, C, to and fro at pleasure. The fore end of the rack is attached to the end cross bar, H, which forms a part of an open traversing frame. This portion of the apparatus consists of two side pieces, I, through which pass the two adjusting bars, J. The side pieces, I, are adjusted to the desired width asunder, and are fixed to the bars, J, by means of the pinching screws, K. At the front ends of the side pieces, B, are fitted in each two laterally projecting studs, carrying the antifriction rollers, L. The peripheries of these rollers rest upon the journals of the die or mill, M, the surface of which rests upon the glass, paper, or other material, N, on which the photographic image is impressed or put on. With this arrangement, it follows that when the rack, C, is moved backwards, and the photographic picture which is to be transferred to the die or mill, N, is properly arranged on the base, A, that upon turning the handle, G, the die or mill, N, will be rolled over the photographic film, and the die or mill having been previously prepared with a suitable varnish, the film adheres thereto, so as to completely coat its surface. The traverse of the moving parts of the machine being very regular, the utmost accuracy is obtained in the junction of the edges of the film, as well as of the lines and figures forming the design or other photographic impression. In this way photographs may be readily transferred to dies or mills, either from gummed paper or at once from the glass. When there are several colours in the design, pattern, or picture to be prepared, one or other of the following modes may be advantageously employed. A photograph is transferred on to a die, and the outlines of all the colours are then etched or engraved through the film. From this die an impression in white or other colour is put upon as many dies as there are colours to be printed, the surfaces of these several dies having been previously varnished. The outlines of the figures for each separate colour are then etched in upon their respective dies. The coating of varnish is then entirely removed, and they are recoated or painted with varnish up to the outline etched upon each die. The dies are lastly immersed in acid, which eats away the metal to the required depth, and, when necessary, are finished by the engraver. From these dies the mills are prepared for engraving the printing rollers, according to the ordinary mode.

EMBANKMENT OF THE THAMES IN LONDON.

It appears from the report of the commission* appointed to consider the question of an embankment of the Thames, that more than fifty designs were sent to them for examination. Great engineering skill and ability are said to have been displayed by many of these designs.

The main features of the majority of them were an embanked roadway on the north side of the river, and the formation of docks with the view to retain all the existing wharves; in others, railways, in addition to the roadway and docks, have been proposed; while, in a few, a solid embankment and roadway without either docks or railways have been suggested. Among the latter is a plan submitted by Mr Shields, some of whose suggestions appeared to the commission to afford, in a greater degree than any of the other designs, the basis upon which an efficient and economical scheme might be founded.

The wharf property between Westminster-bridge and the Temple-gardens is for the most part devoted to the coal trade. Great facilities are now afforded for the distribution of coal by the new system of unshipping in the docks into railway waggons, and by various depots on the railways in and near the metropolis. And public convenience no longer necessitates the continuance either of the coal or any other trade in this immediate locality. It is thought that it would not be expedient to construct and maintain docks for the sake of preserving the existing wharves between the points we have mentioned; while their removal would greatly simplify the formation of the embankment, and add to the beauty of the river. The wharf property, however, between the Temple-gardens and Blackfriars-bridge cannot be so treated; and that eastward of Blackfriars-bridge is so important, in a commercial point of view, that interference with it is not recommended.

Having regard to these and other considerations, the commission were of opinion that the requirements of the public would be best provided for by establishing a spacious thoroughfare between Westminster-bridge and Blackfriars-bridge by means of an embankment and roadway; and that the new thoroughfare thus created should be continued on eastward from Blackfriars-bridge by a new street, according to the line formerly laid down by Mr Bunning, the City's architect, from the west end of Earl-street, across Cannon-street to the Mansion-house. Without such a street no relief whatever would be given to the crowded thoroughfares of Ludgate-hill, St Paul's Churchyard, and Cheapside.

The line of embankment at Westminster would coincide with the terrace of the Houses of Parliament, and thence to Blackfriars-bridge would nearly follow the line laid down for the Corporation of the city in 1841, by Mr Walker, Captain Bullock, Mr Saunders, and Mr Leach. The general level of the embankment and road would be 4 feet above Trinity high-water. The road would commence at Westminster by an easy descent opposite the Clock Tower, and be continued on, 100 feet in width, to the eastern boundary of the Temple-gardens; from this point the road would be reduced to 70 feet in width, and carried on a viaduct supported by piers of masonry, rising to the level of Blackfriars-bridge, so constructed as to leave a breadth of water for the convenience of the City Gasworks and the adjoining wharves of about 70 or 80 feet. The spaces between the piers under the ascending road would be left available for barges to lie, and afford easy access to the water between this structure and the wharves.

From Westminster-bridge to the eastern boundary of the Temple-gardens, the embankment—sustained by a river wall—would be solid in its whole breadth; which breadth opposite Richmond-terrace would be 220 feet from the existing river wall. At Hungerford it would be 320 feet from the existing wharf; at Somerset House about 120 feet, and at the Temple about 220 feet. The plan accompanying the report sets forth the entire scheme.

With respect to the appropriation of the reclaimed land, it is recommended that so much of it as is in front of the Crown property—which will be about 120 feet in width in its narrowest part—should be laid out in ornamental gardens for the accommodation of the occupiers of the houses, and that the portion in front of the Temple-gardens, also about 120 feet wide, be placed at the disposal of the Society, to be dealt with in a similar manner. The other portions of the reclaimed land may either be kept open for the health and recreation of the public, or be applied to building purposes.

It is proposed that communications should be made with the intended roadway from Whitehall, opposite the Horse Guards, and also from some of the streets in the Strand—and that a new street should be formed, passing through the Savoy to Wellington-street. The frontages on these streets would offer eligible sites for building, as would also the inner frontage of the new road, if it should hereafter be thought fit so to utilise the ground. While economy and utility in laying out and disposing of the ground should be kept in view, it is however recommended that endeavours should be made to invest this new and conspicuous work with some elements of interest and beauty.

For the improvement of the navigation it is recommended that the existing shoals between Waterloo and Westminster bridges should be removed, due regard being had to the foundation of the former. Also that an uniform low water channel of six feet in depth at ordinary spring tides, and 500 feet in width from the embankment wall, be secured, and thus the stream be more equalized in velocity. If at any future time any effect should be produced on the river from the diminution of its capacity for tidal water by reason of the embankment, arrangements may be made higher up the river by dredging, or by a tidal reservoir, to compensate for the loss. The consideration, however, of this matter would naturally devolve on the Conservators of the River Thames.

The proposed embankment and street would afford an opportunity of making the low level sewer without disturbing the Strand or Fleet-street, and at the same time facilitate the construction of the sewer eastward of the embankment.

The construction of an embankment on the Surrey shore is not recommended at present, but if hereafter it should be thought desirable or necessary to embank any portion of it, the scheme proposed for the Middlesex side would not in any way interfere with it.

As to the expense of the proposed scheme, the cost of the land, making compensations, constructing the embankment and roadways, and also acquiring the property in the city for and forming the new street to the Mansion-house, are estimated at £1,500,000. This amount, however, would be reduced, should it be thought right to dispose of any of the reclaimed land on the bank of the river for building purposes.

Looking at the magnitude of the work, the important and varied interests, both public, and private, which would be affected—and the urgent necessity for its early completion—it is recommended that the control and management of the undertaking should be intrusted to a special commission, appointed by the Crown, in order to insure the speedy and economical attainment of an object so much needed by the public, and affording so favourable an opportunity for the improvement of the river and adornment of the metropolis.

NEW BLACKFRIARS BRIDGE.

The Bridge Committee have at last set themselves vigorously to work, and have decided upon putting an end to the expensive trickerings and costly repairs of the present structure, and to replace it with a superb bridge worthy of the great city and of the great thoroughfares which it will link together. Out of twelve architects and engineers who have competed for the honour of building the new bridge, the committee have unanimously decided to accept Mr Page's design, which combines in a high degree boldness of conception with elegance of appearance, or in other words, uniting in happy combination simple grandeur with chaste magnificence. There are to be only three arches, the centre one having a span of 280 feet, which is 40 feet wider than the central arch of Southwark Bridge. The side arches are to be 220 feet span; from the springing of the arch to the crown will only be a rise of 20 feet, which in a span of such extent only amounts to the most gentle curve. The piers will be 28 feet wide by 120 feet long. There will be two of these built upon Mr Page's plan for avoiding the use of coffer dams, in the following manner:—Over the whole area will be driven bearing piles of elm, deep into the clay, at intervals of 3 feet apart. Round this will be driven cast-iron piles to the greatest depth to which they can be forced. These iron piles are of a peculiar shape, and cast with a groove in their side, capable of containing the edge of a slab of granite 2½ feet thick. Between these iron piles these immense slabs of granite will be slid to a depth of nearly 12 feet below the bed of the river, and rising to low water mark. All the area of the pier thus enclosed will then be carefully dredged out between the bearing piles, and the slabs of granite, iron piles, and elm all firmly bolted together by a series of iron tie rods. The space will then be filled in with concrete up to a little below low water mark, where the courses of solid granite commence. The whole pressure on the foundations will not exceed three tons per foot, very much less than half of what most of the metropolitan bridges exert on their bases. The arches are to be formed of wrought and cast iron combined. As in Westminster, they will be of cast iron up to near the crown of the arch, and the rest of wrought iron ribs. Thus, of the 280 feet span of the centre arch, about 100 feet will be of wrought iron. The two smaller arches, of 220 feet, will have about 70 feet of wrought metal. In all, about 5000 tons of cast iron and 1000 tons of wrought will be required. On the crown of the centre arch the city arms, with its supporters, will be emblazoned; over the side arches the city shield. The spandrils of the outer rib on each side will be closed, but filled up with figures in bas relief and rich ornamental scrollwork. The cornice beneath the parapet is of an exceedingly bold and handsome design, with a parapet above of solid granite. The piers, however, form the most massive and noble looking features of the whole. These will be four in number, all of granite, and of immense size, width, and depth. Each on its extremity will be surmounted with a column of polished red granite, for which in size and massiveness we must look for parallels among the rock-hewn temples of Egypt. They will be Doric columns, 40 feet in height, 23 feet in diameter at base and capital, and no less than 18 feet diameter in the column. Each of these, though built hollow, will weigh upwards of 500 tons. Their capitals will reach to the summit of the bridge, and it is intended hereafter to surmount them with colossal groups of statuary. The whole structure will only be a few feet longer than the present bridge, but its width will be nearly double—namely, 76 feet against 42. There will be two footways of 14 feet wide, instead of as now two of 7. There will be two tramways of 8½ feet each. These will be in the centre of the bridge, leaving two roadways of 16 feet each for the light traffic, and omnibuses going and coming. The whole area of road and footway will be nearly 78,000 feet, instead of 41,000, the area of the present bridge. The appproaches to the bridge will be wider and at a much less steep incline than at the present, the gradient being reduced from one in 24 to one in 40, while the highest part of the structure will be a little more than 9 feet lower than the present. The whole surface of the foot and roadways will be formed, as at Westminster, by buckle plates of iron, fastened between the ribs. Over this will be a layer of blocks of wood and asphalte, and over all a layer of granite pitching. Every rib and girder will be tested to about double the strain it will be required to bear.

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* The members of this commission were Messrs William Cubitt, Joshua Jebb, Edward Burstal, Henry A. Hunt, and John Robinson M'Lean, and Capt. Douglas Galton.

It is considered that the new bridge will occupy about three years in building, and now that the design has been decided upon, we trust that no unnecessary delay will take place in commencing the works.

RECENT PATENTS.

BAND SAWING MACHINERY.

Arthur Kinder, *Westminster.—Patent dated December* 15, 1860.

Mr Kinder's name is well known in connection with machinery for cutting wood, and we have before had occasion to speak in terms of commendation of some of his ingenious mechanical arrangements. His present invention relates to certain peculiar arrangements and modifications of what are known as band saws, whether working vertically or horizontally, whereby they are rendered more effective in practice, and less liable to derangement.

The first part refers to the employment of guides through which the saw runs either vertically or horizontally, suitable recesses being formed for the reception of packing, whereby the saw is maintained the same temperature throughout its width, and consequently the warping or twisting of the blade is prevented. In combination with a band saw arranged as above described it is proposed to use a convenient arrangement of variable feed, consisting either of a reverse cone motion or a friction disc and bowl or pulley.

The second part refers to improvements for the cutting of curved work, such, for example, as the edges of cask staves, by a band saw placed either vertically or horizontally, and guided to the desired curve by passing through a curved slot in a guide block provided with packing, as above described, the saw being sufficiently wide to project below the guide block and pass through the material, the cut being at the same time made in the direction of the length of the stave.

The third part has reference to the use of a band saw suitably steadied in packed guides, for jointing bent staves for casks, the cut being effected in the direction of the length of the stave.

And the fourth, to the use of nipping rolls carried by the two arms of a pair of nippers, which are pivotted to a fixed support, and capable of being guided laterally so as to suit the work passed between them, and ensure the cut which is made by the band saw being always parallel to the one side of the material operated upon.

Fig. 1 of the accompanying engravings represents a front elevation of the guide block for vertical or horizontal band saws with the packing contained therein; and fig. 2 is a plan of the same. The plate, *a*, fig. 1, being turned over on the screw, *b*, the recess, D, in the guide block, C, for the packing and the opening for the saw, B, to pass through, shown by dotted lines, will be exposed, the saw, B, being placed in the machine, and passed through the guide block, C, the plate, *a*, is closed, the back of the saw being held against the grooved bearing wheel, E. A piece of wood, F, of a suitable width, and shown to a larger scale in side and end view in fig. 3, having a groove made down one edge is inserted into a recess; the groove in this piece of wood covers the saw teeth, and leaves a small space on each side of the saw at G, seen in fig. 2, into which the packing may be compressed so as to keep the blade at an even temperature throughout its whole width. This packing may consist of hemp, cotton, or other similar substance. Fig. 4 is an end elevation of the improved band sawing machine, showing the self-acting variable feed gear as applied to the traversing table, and fig. 5 is a side elevation of the same at right angles to fig. 4.

Fig. 1.

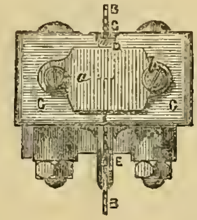
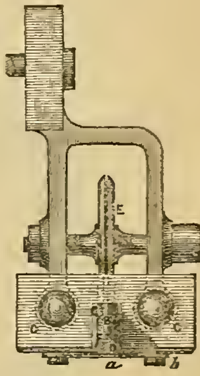


Fig 3.

Fig. 2.



A, is a strong cast-iron foundation plate resting upon suitable masonry; B, is a cast-iron standard firmly bolted to the foundation-plate, A; this standard carries the upper or tension pulley, C, over which the saw passes. To the under side of the foundation plate, A, are fixed two pendent brackets; these are provided with journals, in which the main shaft, D, is mounted, carrying on one end the lower saw pulley, C. E, is a fast and loose belt pulley on the shaft, D, which drives the machine; F, is a drum keyed on the saw shaft, D, sufficiently wide to carry the cross and open belts which transmit motion to the pulleys, G; these pulleys are mounted upon the shaft, H, which is carried in suitable bearings, I, bolted to the foundation, J. On the end of the shaft, H, is mounted a sliding socket carrying the friction bowl, K; this bowl drives by contact the disc plate, L, keyed upon the shaft, M, carried by the brackets, N. The disc plate is kept in contact with the friction bowl, K, by means of the spring, O, acting upon the end of the shaft, M. On this shaft, M, is keyed the small pulley, P, which transmits motion by means of a strap to the pulley, Q, carried upon the shaft, R, to which it is engaged by means of the sliding clutch-box, S, shown in dotted lines in fig. 4. On one end of this shaft, R, is keyed a bevelled pinion which takes into the bevelled wheel, T, keyed upon the vertical pinion shaft, U; the upper end of this shaft carries the rack pinion, V, which takes into a spur rack fixed to the under side of the travelling table, X. This table slides in suitable guides and on antifriction rollers in the usual manner. Y, is the log to be cut placed upon the table.

a, is a shaft mounted in suitable bearings bolted to the under side of the foundation plate, A; on this shaft, *a*, are a pair of pulleys, *b*, and on one end is keyed the bevelled wheel, *c*, which gears into a similar wheel keyed upon the shaft, R. The pulleys, *b*, receive an independent motion from the main driving shaft. *d*, is a sliding bar carrying a strap guide; this bar is moved by the arm, *e*, keyed upon the vertical shaft, *f*. On the lower end of this shaft, *f*, is placed a lever with a projecting pin, which takes into a groove in the sliding clutch-box, S. When the shaft, *f*, is moved by means of the lever handle, *h*, the sliding clutch-box, S, is disengaged from the pulley, Q, and as the motion of the handle is continued, the driving strap, *i*, is moved from the loose to the fast pulley, *b*, thereby giving a quick return motion to the traversing table, X. *l*, is a vertical shaft mounted in suitable bearings, and carrying at its lower end the lever, *m*; this lever takes into a groove in the socket of the bowl, K. On the upper end of the shaft, *l*, is fixed the hand lever, *n*, and by turning this lever the friction bowl, K, is moved to and from the centre of the disc plate, L, thereby communicating a variable feed motion to the traversing table, which carries the timber to the saw. *o*, is a vertical shaft, which by means of an arm on its lower end and a lever handle on its upper end moves the cross and open straps upon the drum, F, and the pulleys, G, thus affording facility for reversing the feed at any moment. The centre of the disc, L, is hollowed out or cut away so as to enable the feed to be stopped by bringing the bowl, K, over such portion. *p*, is another vertical shaft giving motion to the band fork belonging to the main driving strap upon the pulleys, E, for the purpose of stopping and starting the mill.

Fig. 4.

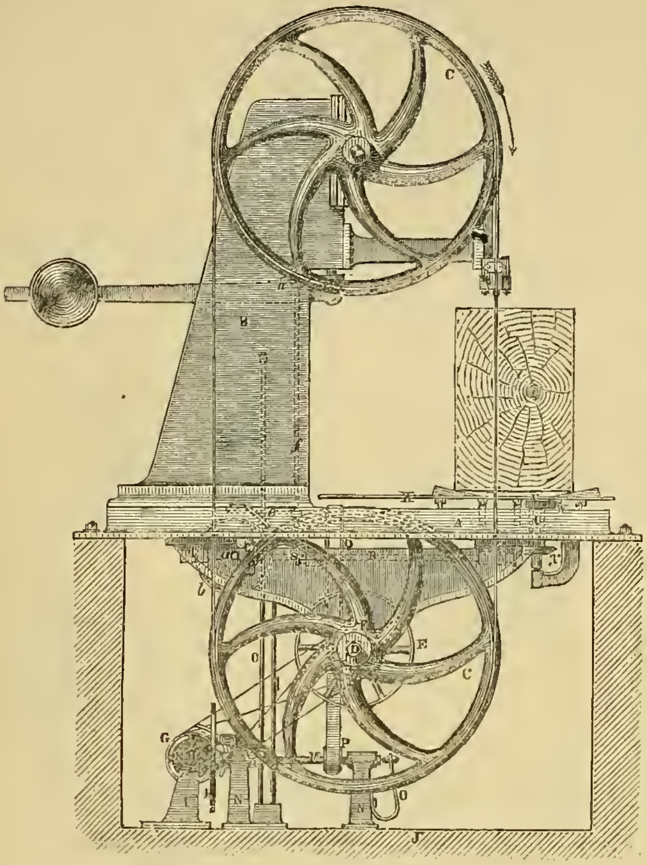


Fig. 5.

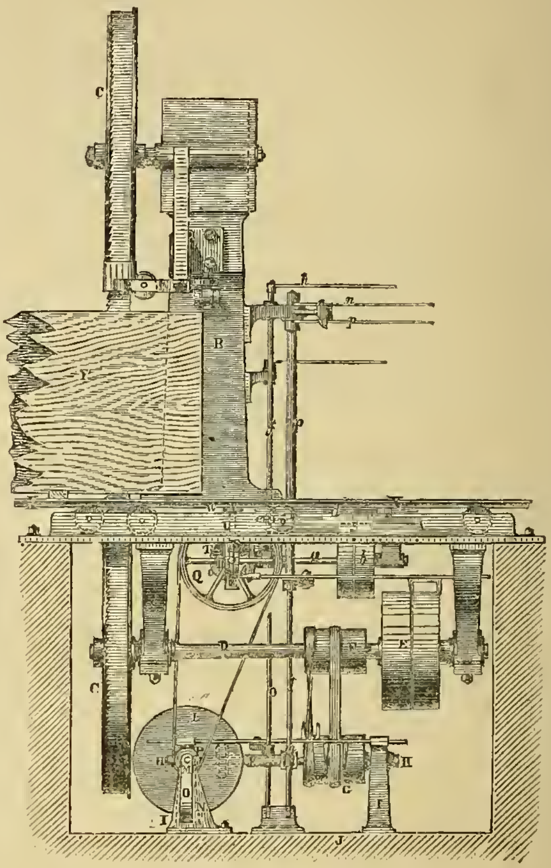


Fig. 6 is a plan view of the arrangement of a horizontal band saw for bevelling and curving the edges of the flat staves of casks, and fig. 7 is a vertical section of the same on the line *a*, *b*, and corresponding to fig. 6. Figs. 8 and 9, are similar views of a horizontal band saw for bevelling and curving the edges of bent staves; the section, fig. 9, being taken along the line *c*, *d*, in fig. 8; fig. 10, is an enlarged section taken along the line *d*, *e*, in fig. 6; and fig. 11 is a similar section taken along the line *f*, *g*, in fig. 6. The pulleys, A, fig. 6, over which the endless saw, B, is strained, are placed horizontally; the necessary curvature for curving the edge of the stave is given to the saw by running it through the curved guide, C, which is of such a depth as to allow a sufficient portion of the saw, B, to project from it, as shown in the sectional elevation, fig. 7. The recesses, D, in this guide are packed in the manner previously described in reference to figs. 1 and 2. The guide may be used without packing, in which case the recesses, D, would be dispensed with. E, are two packing blocks or guides embracing the whole width of the saw, the recesses therein being filled with packing, as previously described, for the purpose of keeping the saw at the same temperature throughout its whole width as before mentioned, and more particularly shown in the enlarged view, fig. 11. In applying this to the cutting of barrel staves or similar work, the stave, G, is placed upon a suitable support, *g*, which support has a vertical traversing motion applied to it by any ordinary means; and it follows, that the portion of the saw, B, which projects below, C, will cut the desired curve upon the edge of the piece, G, and will also bevel the edge at the same time if the stave be tilted sufficiently, as shown in fig. 7.

The views, figs. 8 and 9, show the position of the saw when operating upon bent staves, in which case the cut on the edge of the stave is straight; the curved guide, C, fig. 6, is therefore dispensed with, and the guides, E, alone are retained. The bent stave, H, is fixed in a suitable position upon the table, *g*, and is passed upwards against the saw, when the superfluous timber is removed, and the edge of the stave receives its proper curved and bevelled form. In both arrangements the saw acts upon the whole length of stave simultaneously.

Fig. 12 is a plan of an improved floating roller fence for holding staves or other twisted timbers during the process of cutting, so as to ensure the cut being parallel to one of the sides; and fig. 13 is a front or end elevation of the same. A, is a suitable hanging support at the back of the saw, B, and which carries the pivot pin, C; upon this pivot are mounted the nipping arms *d*, and D. The back end of D, carries the spring, E, and *d*, has an adjusting screw bearing against the point of the spring, E, so that the pressure of the spring can be adjusted to suit the width of the timber, X. The handle, F, is fixed to the front end of the nipping arm, *d*, and carries a crank lever, G, to the end of which is fitted the chain barrel, H, which can be secured by the ratchet wheel and pall, I. A chain, K, passes from this barrel, H, round a guide pulley in the end of the arm, D, and is secured to the end of the arm, *d*; it

Fig. 6.

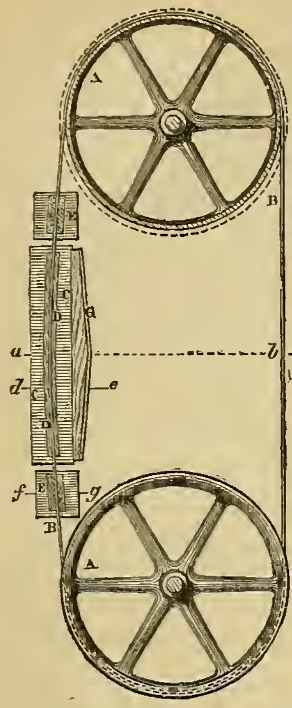
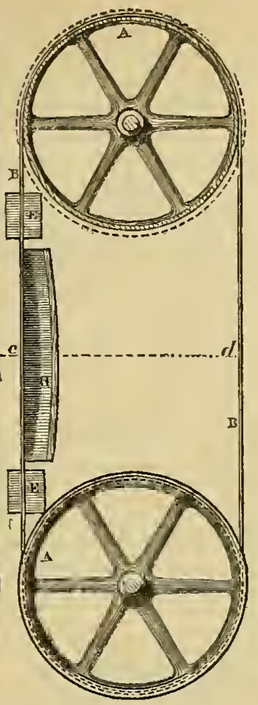


Fig. 8.



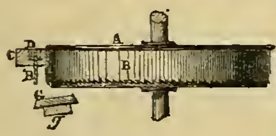


Fig. 7.

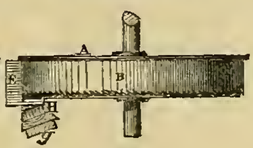
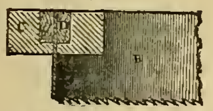


Fig. 9.

Fig. 10.



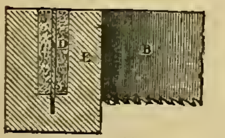


Fig. 11.

Fig. 12.

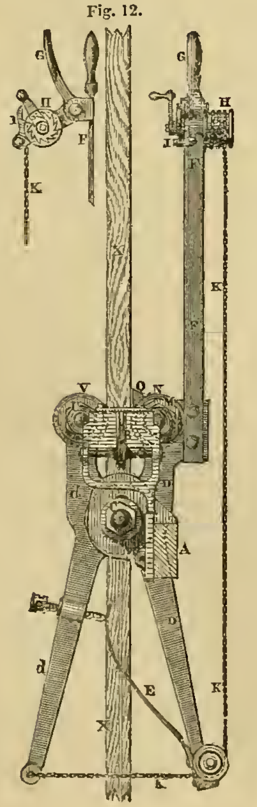
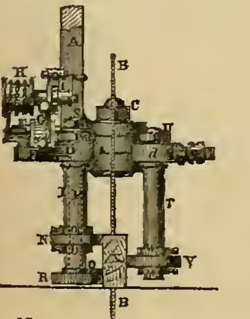


Fig. 13.



follows, that by depressing the handle, G, the back ends of the nipping arms, *d*, and D, are closed, and the front ends are opened. The front end of D, has a hollow stud, L, fig. 9, attached to it by the nut, M; upon this stud the roller, N, can be fixed in any position by the retaining rings, O, an internal spindle, P, carrying the fence guard, Q, and roller, R, swivels freely at the lower end of the hollow stud, L, and is retained in position by the nut, S. The arm, *d*, has a solid stud, T, secured to it by the nut, U, the roller, V, upon this stud being adjustable vertically, and capable of being secured at any height by the retaining rings, W. The timber that is being passed through the machine is shown at X, as pressed up against the fence guide rollers, R, and N.

In applying this apparatus, the operator takes the handle in his left hand, opens the nipping rolls by the action of the crank lever, G, and pushes the timber forward against the saw with the right hand, turning the timber about to adapt the curve of the cut to the saw, and bringing the fence rollers nearer to or farther from the saw with the left hand to suit the sawing as required; as the rollers, R, and N, are always parallel with the saw, and the fence guard, Q, preventing the bottom roller entering any indentations, it follows that the sawing must be parallel with the side of the material.

PLOUGHING MACHINE AND TRACTION ENGINE.

James Austin, *Glasgow.—Patent dated Dec.* 1, 1860.

The specification of this invention comprehends an improved arrangement and construction of steam ploughing or cultivating machinery. According to the present invention the ploughing is performed in a direction at right angles to that in which the engine is progressing, but only one frame with duplex traversing ploughs is used. This consists of an open carrying frame about six feet long, and about three feet wide. Near the backward end is a supporting axle which runs in adjustable pedestal bearings. These pedestal bearings have flanges cast on them which fit guides pendent from the framing. This axle has at each end a large broad travelling or carrying wheel; these wheels are put on the axle loose, but during the ploughing are fastened to it either by a clutch or other equivalent contrivance. At the fore end of this frame are two pedestals or eyes placed in the middle, one on the front part of the frame, and the other on or in a bridge about eighteen inches behind. Into these eyes or pedestals are let the stud of the outer ring of the traction engine. This now carries the fore part of the frame that runs on the broad wheels and steadies the engine, at the same time it admits of each pair of wheels going over obstacles without twisting or straining any part. When ploughing, the hinder or broad wheels are made the propellers. This is done by a worm wheel keyed on their axle; the worm that drives it is vertical, and runs in two bridge pieces fastened to the side of the frame. The worm is made very long, so that it may be in gear whether the axle of the broad wheels be up or down. On the upper end of the vertical worm shaft is keyed a ratchet wheel; two levers with palls work this ratchet, one to the right side, and one to the left; the fulcrum of these levers may be the worm shaft. There are rods carried from each end of these levers which work on a crank near the foot of an upright shaft. The lower end of this shaft is carried by a footstep bearing fastened to the hind part of the carrying frame, and its upper end by a bridge raised above. On the upper end of this upright shaft is keyed a pulley right in line with the fly-wheel of the engine. A strap from the fly-wheel gives this pulley motion, consequently the crank at its foot works the rods that join the end of the pall levers. One throw of the crank moves the ratchet wheel partially round, the other throw moves it still farther in the same direction, owing to the pall being on the other side of the ratchet wheel. This nearly constant circular motion is communicated to the worm wheel on the main travelling axle by the long worm on the upright or ratchet shaft. The rods where they unite with the pall levers are adjustable, so that they may be shifted nearer the fulcrum or farther from it for the purpose of making narrow or broad furrows. On the end of the frame which runs on the two large broad wheels is hung at the centre of it the long plough frame with its set of ploughs, and so arranged that when the pedestal screws are turned, the ploughs will be let down into or taken up out of the ground. This plough frame is hung by two studs going into eyes in the hind part of the forward frame, and is keyed, but not permanently. The frame is not set at a right angle to the forward framing, but nearly the breadth of the furrow that is being ploughed off or away from it. This plough frame may be about fourteen feet long. It consists of a flat piece of timber about two feet wide, having at its ends openings or spaces cut out for wheels of about three feet in diameter, and about six inches wide to run in. A pedestal bearing is placed at each side of these openings for their axles. One of the axles is made to project a few inches towards the engine, on which is keyed the driving worm wheel. On the rim of the wheels that run in the spaces are set, at equal distances round them, about a dozen forked guides on each for an endless rope or chain to run on. At equal distances from each other on this endless rope are placed the ploughs or other cultivators which travel towards the end of the frame that is farthest from the engine. A few inches from each side of the rope or chain, and all along its course, are guides of bar iron supported from the main flat piece of timber above by upright standards, and below by similar pendent supports. The guide that is nearest the engine is the height of the rope above the flat wooden centre, and the same depth below it. The other guide does not spring so high or descend so low, but is several inches from the line of rope. The upper guides are set so as to fit easily against the flanges of the plough roller. The under guides are set wider than those above, so that they may bear on the outside rollers of the plough on pendent cranked supports; parallel therewith are other bars of iron or guides about six inches nearer the ground. These are set the width of those above, and on these the plough rollers travel or run. The ploughs are of the common shape so far as coulter mouldboard and sock are concerned. The beam is about three feet long, and from the middle of it hangs the curved prong on which is fastened the mouldboard and sock. At each end of the beam are studs projecting outwards, on which run the carrying or guiding rollers. These rollers are in pairs; that is, two rollers are on each stud. The ones next the plough are flanged, the flange being next the plough, the outside roller at the front end not being so broad as the one at the hinder end. Another pair of rollers, the one next the plough being flanged also, run on a stud, which is held by an arm from the mouldboard side, and opposite the rollers at the hinder end of the beam only higher; that is, supposing the plough in its ploughing position. The height of this arm is just the difference in height that exists between the two guide rails that are set in a line with the rope. The ploughs are drawn by the rope from the centre of the beam by a short cross-bar fastened to the rope. One extremity of this bar goes into an eye in the beam, and the other into an eye in a piece of iron, which is fastened to the beam opposite to the other. These eyes are set a little above the level of the beam, so that the ploughs may be facilitated in going over the wheels on which the rope runs. At the end of the ploughing frame nearest the engine, that is, the end at which the ploughs enter, are raised inclined guide rods on the upper side of the frame, and outside of those that are set in a line with the rope. These guide rods catch the outer rollers of the plough at its backward end just as the front roller begins to descend, and lift it so that the roller at the point of the beam may be kept close to the guides in a line with the rope until it is entered between the guides and the lowest rails. Firstly, the roller at the point of the beam, and shortly after as it is drawn along those at the other end, and so they run until the plough reaches the extreme end, when it is lifted out of the ground. The rollers at the backward end are kept close to the guides, which are set in a line with the rope, and the point of the plough comes gradually down on the top side of the guide, a spring bar or stopper being so arranged as to keep the motion easy. The ploughs are driven by the upright shaft at the end of the forward carrying frame, or the one which has the pulley at the top of it. This shaft is driven by a strap from the fly-wheel, and on it is keyed a bevel wheel, which gears into a suitable bevel wheel that drives a horizontal shaft placed in line with the long plough frame. The pedestal bearing of the shaft, at the end where the bevel wheels are fitted, is carried on the backward end of the forward frame, and the bearing at the other end by an arm projecting from the plough frame. At the end of this shaft is a worm which gears into a worm wheel keyed on that part of the axle of the plough wheel, or chain wheel, which projects next the engine.

The second part of the invention relates to the arrangement and construction of a locomotive engine suitable for giving motion to the ploughing apparatus as well as for other purposes.

The propelling or traction engine is constructed with an upright cylindrical boiler, which is by preference composed of steel plates, or what is known as the patent homogeneous metal boiler plates, so to combine lightness with strength. The interior of the boiler is strengthened by means of vertical stays arranged three or four inches apart, and connecting the crown of the boiler with the upper part of the furnace. The diameter of the furnace is somewhat less than the boiler, so that it is completely surrounded with water, with the exception of a circular aperture, which is made through the boiler shell and the furnace casing. This opening serves for the admission of the fuel, and also as an exit for the smoke and products of combustion which pass off into a circular flue formed outside the boiler by means of light sheet iron. On each side of the opening to the furnace is arranged a vertical tube, which is bolted to the boiler shell, and communicates with its interior. Another and similar vertical tube is fitted to the shell of the boiler at a point on the circumference between the two just referred to. These vertical main tubes are connected to each other by a series of horizontal heating tubes of small diameter. The flue is formed by enclosing this arrangement of heating tubes with an external casing of light sheet iron, which may, if necessary, be constructed double so as to form an air space around the flue. This circular flue is enclosed at the lower part by moveable plates to admit of the flue being cleansed when required. The products of combustion pass from the tubulated flue into a spiral flue, which is carried once or twice round the boiler, and from thence into a chimney fitted over the flue at one side of the furnace door. In this way a very large amount of heating surface is obtained, and which is comprised in a small cubical space. The arrangement of the tubes in the under flue for obtaining heating surface may be carried out in various ways. The one preferred consists of two horizontal tubes joined by flanges to the outside shell of the boiler, at each side of the opening into the fire-box, and communicating with the interior of the boiler. One of these tubes is placed at the top of the under flue, and the other at the bottom of it. They both stand out in the middle of the flue. On the top side of the under tube, and on the under side of the upper one, are brazed pieces of brass arranged opposite to each other for the purpose of strengthening the tube, so that vertical helical tubes may be screwed into them. These helical tubes have kneed brasses brazed to their ends. The knee parts are screwed right and left, so that the vertical helical tubes may be screwed into the brazed parts of the horizontal ones. The helical tubes are placed all round the flue nearly touching each other. About half way up the exterior of the boiler, is bolted a ring of angle iron, which has eight radial arms supporting a ring of larger diameter at each side of the boiler, supposing the chimney to be in the front. Two plates are riveted to the radial arms; these are arranged parallel to each other, and from the centres are hung two guides, between which the pedestal bearings of the main axle slide. To steady these guides, stays are fitted near their lower ends, and extend outwards to the ring above in a diagonal direction, a helical or common spring being placed above each bearing. On the extremities of the main axle are fitted the bearing wheels, which run loosely on the axle, and the parts connected with these wheels are so arranged within a second horizontal flanged ring as to admit of their acting as steering as well as bearing wheels. This is effected by means of an iron bar, which is secured to the inside of the outer ring above the inside ring, and by another bar fastened in like manner under the inside ring. The outer ring is made with a laterally projecting part or prolongation to admit of its being attached to the front frame of the plough, or to a vehicle for the purpose of drawing or propelling the same. The engine for imparting the propelling power is fitted on the upper part of the boiler, the cylinder being arranged horizontally inside the chimney. The rectangular frame on which the engine is fitted has a vertical stud in it which carries the horizontal fly-wheel. A pin is screwed into the nave of this wheel which forms the crank, and to which the connecting-rod is attached. The crank pin is made duplex; that is to say, it is bent at the part above the connecting-rod, in a horizontal direction, and again vertically, to which part the eccentric or other actuating detail of the slide valve motion is attached. The rim of the fly-wheel is all on the lower side of the wheel, and it gives motion by frictional contact with the inside of the rim to a pinion on the upper end of a vertical shaft, the bearings of the shaft being adjustable so that the pinion may be regulated as regards its pressure on the rim of the fly-wheel. A worm on the lower part of the vertical shaft gives motion to a worm wheel on the main axle, and this motion is communicated by means of arms which are keyed thereto to moveable pins in the naves of the wheels. The driving worm is not fastened to the vertical shaft, but is carried in a bearing, which is supported at the end of an arm that is attached to the contiguous pedestal of the main axle. The worm is made with a feather in the boss, and there is a corresponding groove in the vertical shaft. In this way the worm is free to slide up and down the shaft in accordance with the compression or distension of the supporting springs, caused by the inequalities of the road, and consequently the worm cannot get out of gear with the wheel on the axle. The peripheries of the driving wheels are fitted, if required, with curved springs or prongs which enter the ground as the machine is propelled along, and so give it an increased hold on the ground. Opposite the stud or prolongation that goes into the eyes of the forward carrying frame of the plough is a similar stud or prong fastened to the outer ring. This stud carries a small shaft with a roller at its end next the ring, and a hand or steering wheel at its other end. On the roller is fastened a chain, the ends of which take hold of the radial arms at a point above the main axle. This same stud or prong has hanging from it, within a foot or so of the ground, a piece of iron, to which is fastened a cross piece parallel with the main axle. On this is fastened a foot-board for the stoker or steerer, by means of two or three stays from this to the ring, projecting ends being left for small wheels to run on, so that the engine may be removed from place to place of itself in a lying back position. A circular water tank is placed on one side of the boiler above the radial arms, and a similar box for fuel on the other side. An agricultural engine constructed according to this system is not only well adapted for propelling ploughing or cultivating machinery, but may also be employed generally as a traction engine when detached from the plough frame. When this machine acts as a plough, the engine is connected by the prolongation of the outer ring being let into the eyes of the forward frame of the plough, and a pin or key driven in behind one of the eyes. The pins in the naves of the engine wheels are withdrawn clear of the arms on the axle, and the friction pinion is put clear of the rim of the fly-wheel. The small wheels at the sides of the stoker's foot-board are taken off, and a strap put on the fly-wheel, and on the pulley at the end of the frame on the broad wheels.

When the engine is used, it is detached from the plough, and for traction purposes the pins in the naves of the two wheels that it runs on are brought in contact with the arms of the axle. The small wheels for the sides of the foot-board are put on. The friction pinion is screwed against the rim, and on steam being admitted to the cylinder the engine is run up to the vehicle to which it is to be attached, and when connected thereto the small wheels are taken off.

In attaching it to a vehicle, the prong that goes into the eyes at the front of the plough carrying frame may, by having a suitable socket in the front or locking bar of the vehicle that it is to draw, be similarly yoked. But as the engine is purposely built as light as possible, and might be too light to have a sufficient hold of the ground to ascend steep gradients, the vehicle, as for example a lorry or waggon, is constructed without front or locking wheels; but it has a strong bar of iron or piece of timber bolted to the bottom or floor of the waggon on each side, and projecting far enough forward and wide enough to rest on the outer ring on each side of it. The wheels of the engine then become the fore wheels of the waggon or lorry—the load therefore aids in giving adhesion to the road.

FEED WATER INJECTOR.

Thomas Hunt, *Crewe.—Patent dated Dec.* 21, 1860.

This invention comprehends certain improvements upon, and modifications of what is known as "Giffard's feed water injector," whereby a more regular and continuous supply of water is obtained, and the apparatus is rendered generally more uniform in its action. For this purpose a chamber or reservoir is placed in close proximity to the steam jet nozzle of the injector—such portion of the injector is surrounded by a chamber or reservoir of sufficient capacity to contain as much water as will feed the injector at a uniform rate, and neutralize any reaction in the current of the water between its source and the injector.

Fig. 1.

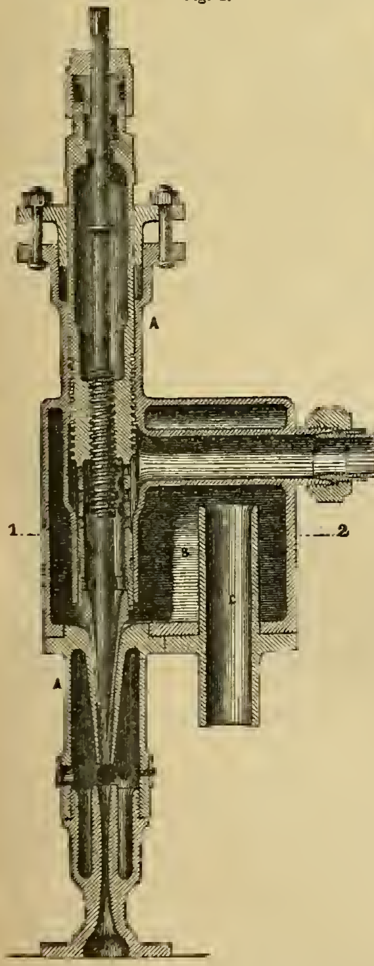


Fig. 2.

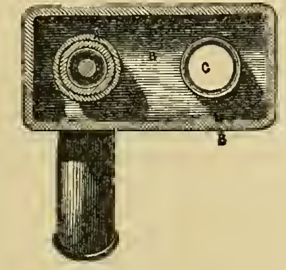


Figure 1 of the annexed engravings represents a vertical section of an ordinary feed water injector with the improvements attached, and figure 2 is a sectional plan of the same taken along the line 1, 2, in fig. 1.

A, represents the outer shell or main body of the injector, and, B, is the reservoir or chamber which surrounds the steam jet nozzle, and which is constantly supplied with water from the tender or other source of supply by the inlet pipe, C. The reservoir or chamber, B, in place of surrounding or inclosing the steam jet nozzle, may be, if preferred, situate on one side thereof, or in close proximity thereto, the lower portion only of the reservoir or chamber, B, or a branch leading therefrom being made to surround the nozzle of the steam jet pipe, the essential feature of the present improvements being the maintaining of such nozzle constantly surrounded by or immersed in the feed water when in action.

CARDING ENGINES.

George Wellman, *Lowell, U.S., America.—Patent dated* 11*th September*, 1860.

This invention relates to certain improvements on carding engines, for which letters patent were granted to J. H. Johnson, 25th Nov., 1853. The present improvements may be readily understood, and they consist in the use of two segmental mangle racks secured one to each side of the box or framing of the carding engine for obtaining the desired to-and-fro travelling motion of the rocker frame which carries the "top" raising and stripping mechanism and driving gear for actuating the same. This rocker frame works round the boxes which carry the ends of the main shaft of the carding drum, and carries near its upper end a double cam gear, which imparts all the motions requisite for raising and stripping the top cards, as well as that for traversing the rocker frame from one top card to another; the rotatory motion of this double cam gear is derived from the shaft of the main carding drum itself, by means of a small pulley carried by the latter and a band, which imparts motion to spur gearing, from which the double cam gear receives its rotatory motion. The motion of one of the double cam gear is transmitted to the other on the opposite side of the rocker frame by a transverse shaft and toothed pinions, so that they both rotate together. One portion of the periphery of each double cam gear is provided with an extra segment of teeth, which gear into and impart one rotation to a pinion carried on the end of a swinging arm jointed to the rocker frame, the axis of this pinion being provided with a set plate, which, by bearing upon a set rim on the double cam gear, holds the pinion stationary after each revolution. A second pinion is also fitted on to this axis, and gears into the teeth of the mangle racks secured to the framing of the carding machine; hence it follows that at each revolution of the latter pinion a forward motion will be imparted to the rocker frame, which motion enables it to pass from one top card to another. One of the two cams contained in each of the double cam gear actuates the slides for lifting or elevating the top card, whilst the other cam imparts the requisite movement to the stripper lever for cleaning the elevated top card. In some cases a peculiar compound cam may be employed for elevating the top cards, by the aid of which the same amount of lift may be obtained with a considerably smaller cam than would be required with one of the ordinary construction. This peculiar compound cam is provided with two or more cam surfaces, which successively operate upon pins on the lifting slides, each cam surface as it comes into action imparting a further lift to the slides. In order that the action of the stripper card on the face of the top card may be more perfect or parallel thereto, the stripper lever is centred on one side of the centre line of the rocking frame, and connected thereto by a bolt passing through a slot in the arm, so as to admit of the adjustment of the height of the stripper card.

The main framing of the carding engine, and the arches which support the series of top cards, are secured, one at each end or side of the engine, to the double mangle pin segments or rims. The shaft of the main carding drum or cylinder projects sufficiently far to support the rocker frame, which is free to vibrate or swing loosely upon the ends of the journal box of the shaft, and carries with it the whole of the "top" stripping apparatus. The top cards are numbered in the usual manner, beginning at the feed rolls with No. 1, and ending the series in this case with No. 20. The rocker frame itself is composed of two arms, which are connected firmly together by a cross bar near their upper ends, their lower ends being provided with a counterweight capable of balancing the entire frame with its appurtenances.

As the gearing and other mechanism is precisely similar on both sides of the carding engine, a description of one side of the engine, and then the mode of connecting it with and driving the duplicate mechanism on the opposite side, will be sufficient. The improved double cam gear consisting of a "gear" or spur wheel is provided with two separate cam grooves, which piece of mechanism imparts all the requisite motions for elevating and cleaning the top cards, as well as that for moving or traversing the rocker frame from one top card to another. A jaw slides in a groove in each rocking arm, and as it rises it takes with it the end of the top, carries it up, holds it in its elevated position whilst the stripping is being performed, and then carries it down again to its seat upon the arch. A perforation or slot is made in the ends of each top card, which when the top begins to rise is intended to receive a dagger or slide fixed to each of the rocking arms, so that by the aid of these daggers and the lifting jaws, the top card may be locked to the rocked frame as long as it is elevated in the lifting jaw. The outer grooved cam formed in the spur-wheel acts upon an antifriction roller carried by a stud fixed in a stripper or arm, which arm in connection with its duplicate on the opposite side of the machine holds and operates on the stripping or cleaning card. A stud or working centre upon which the stripper lever or arm is pivotted, being on one side of the centre line of the arm of the rocker frame, is connected thereto by an adjustable attachment and slot for the purpose of adjusting the height of the stripper card, the inner grooved cam of the spur-wheel with its lifting jaws, and and the outer grooved cam with its stripper lever, are so proportioned and adjusted in relation to each other that the lifting jaws elevate the top card to its full height and hold it there, whilst the stripper levers carry forward the stripping card underneath the elevated top card, and hold it in this position, whilst the continued movement of the inner cam depresses or lowers the top card slightly, so as to lock its teeth and those of the stripper card well together, and hold it in that position whilst the outer cam moves the stripper card back again to its first position, in doing which the stripper card removes or strips from off the top card all the waste and dirt collected upon it. After this operation the descent of the lifting jaws causes the top card to be lowered into its place again on the arch. The series of wheel and pinion teeth are so proportioned that one revolution of a pinion is just sufficient to carry the rocker frame, from one top card to the next but one, so that starting with No. 1 of the series of top cards the rocker frame will stop at every odd number of the top cards until it arrives at the last one near the doffer, and here a change is made by the pinion, which as it turns on the last pin of the series, loses one half of a revolution in passing from the lower side of the pin round to the upper, or *vice versa*, consequently, there is then left but one half of the revolution of the pinion to act on the series of teeth, which is just sufficient to carry the rocker frame to the immediately succeeding top instead of the next but one, and the direction of motion of the rocker frame being changed at the same time, it will stop at every even number on its return to the commencement of the series.

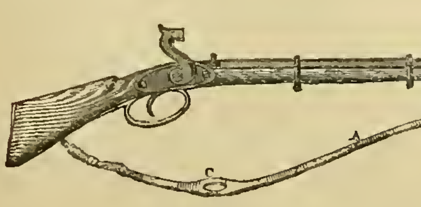
This specification also includes a peculiar compound cam for lifting the elevating jaws of the tops, or for other purposes where a sliding movement is to be imparted. The action of the top raising and stripping mechanism is precisely similar to that above described; but in place of elevating the jaws by an ordinary cam groove, two or more cam surfaces, which operate successively upon pins, in the sides of the lifting slides of the jaws are used, each separate cam surface as it comes into action operates upon one of the pins, depressing or lowering the lifters or elevators. By the use of a cam of this construction, and a series of pins in the slide, a greater amount of lift or motion is obtained with a given size of cam than can be obtained with an ordinary cam of the same size.

RIFLE BELTS.

W. R. Taylor, *Oxford.—Patent dated Oct.* 24, 1860.

The patentee's improvements consist in introducing a spring composed of metal, india-rubber, or other suitable material into the ordinary rifle belt or sling, so as to render it elastic. That part of the belt which is nearest the left elbow when firing is widened slightly, and has a central opening made therein for the reception of the point of the left elbow. The belt or sling is by this means distended, and by exerting a downward pull or strain upon the muzzle of the rifle tends to prevent the rising of the muzzle of the rifle on the explosion of the charge.

The annexed drawing represents an elevation of a long Enfield rifle provided with this improved rifle belt or sling. A, is the belt or sling, which may be connected in the usual manner to the barrel and stock of the piece; B, is a vulcanized india-rubber spring, and C, is the aperture for the reception of the left elbow when firing; the belt, or sling, being made wider at this part for that purpose.



MACHINERY FOR PRINTING YARN.

Henry Henderson, *Edinburgh—Patent dated Jan. 24th*, 1861.

Mr Henderson has, in the present invention, brought the result of a long and extended experience to bear upon the subject of printing fibrous materials. The Patentee's improvements have special reference to a system of printing yarns or threads, for which British Letters Patent were granted to Richard Whytock, and dated the eighth of September, 1832. According to this invention, the yarns to be printed were wound tightly upon a drum or cylinder, and the colours were applied thereto by the workman, who was furnished with a graduated scale to assist him in disposing the colours correctly, both longitudinally and transversely. In subsequent improvements, the colours were placed in troughs, in each of which a roller was partially immersed. Mechanical means were provided for causing these rollers to revolve in the colour trough, and so impart the colour to the yarns, as the carriage on which it was placed, traversed to and fro across and under the drum on which the yarn was wound, the colour roller thus charged with colour, being made to press upwards on the yarn, on the surface of the yarn drum. As the cylinder was turned round intermittently, each traverse of the carriage coloured a certain portion of the yarn or thread. An arrangement of a generally similar kind is at present in use, and one part of the present improvements has reference to the yarn drum or cylinder. Instead of winding the yarn upon a hard inelastic substance, the periphery of the drum is covered with a soft elastic material; vulcanised india rubber is by preference used for the purpose. The sheet rubber is formed into an endless band, corresponding to the size of the drum or cylinder over which it is stretched, the thickness of the india rubber being regulated so as to provide a soft elastic or slightly yielding bed or surface on which the yarn is wound. The object of this addition to the cylinder, is that the flexible surface thus provided shall admit of the yarn adapting itself to the peripheries of the rollers employed for distributing the colours. The colour rollers are ordinarily made of wood, but for this purpose, preference is given to "vulcanite" or hard vulcanised india rubber, or in lieu of this, gutta percha, or other suitable material may be used. Colour rollers made of vulcanite, or a generally similar substance, are not liable to warp or crack. The improved colour rollers are also readily cleansed from colour by simple washing, and may be used in succession for any number of colours. These rollers are arranged in the colour troughs in the usual way, and they are pressed upwards by means of springs. Instead of making these rollers flat on the periphery in the ordinary way, this part of the roller is made concave, so that the periphery forms a flute or groove. The depth of the groove is made so that it will contain a sufficient quantity of colouring matter to saturate the yarn as it passes across under the yarn cylinder; the carriage containing the colour troughs, being impelled across beneath the yarn cylinder, by the mechanical means ordinarily used for the purpose. The springs press the colour rollers up against the yarn, with a sufficient degree of force to cause the yarn to be pressed into the groove and absorb the colouring matter. A highly important advantage attending this mode of constructing the colour rollers is, that it prevents the escape of colour in a lateral direction. With the ordinary colour rollers, on account of the flat periphery, a ridge of colouring matter is left on each side, as the roller passes over the yarn, and it becomes necessary to scrape, rub or roll down these ridges of colouring matters, in order that the colours may be uniformly distributed over the surface. But with these improvements the inconvenience here referred to is entirely obviated, the flexible covering on the yarn cylinder, admits of the yarn adapting itself exactly to the grooved periphery of the colour rollers, whilst the sharp edges of the latter prevent any escape of colour in a lateral direction. In this way, all the subsequent operations of reducing the ridges of colour is avoided, and the printing is effected in a superior manner, because the outline of each colour is preserved in a much more distinct and correct manner. In the ordinary way, the colour boxes are placed in a frame which is supported by springs, and placed on the main frame of the carriage, so that the colour box, the roller, and the upper frame of the carriage are depressed simultaneously. In order to simplify this arrangement, the patentee arranges the colour roller alone upon springs which are connected with the bearings of the axle of the colour roller. These springs may be formed of india rubber, steel wire, or other suitable material, and they are arranged so, that when the carriage passes beneath the drum, the colour roller alone is depressed, whilst the other parts of the carriage remain stationary. In order to give motion to the colour roller after it has passed the yarn cylinder, a small driving pulley is fitted on the extremity of one of the axles of the carriage. This pulley, by means of an endless band, gives motion to a larger pulley arranged on the carriage of the colour box, and on the axle of the colour roller is also another fixed pulley of smaller diameter. In a horizontal line with this smaller pulley, are fitted two others, round these pulleys is passed an endless belt of india rubber, which is carried under the pulley on the axle of the colour roller. As the pulley on the axle of the colour roller rests upon this elastic band, it follows that the roller will be readily depressed when passing under the yarn cylinder, at the same time it is capable of turning in either direction when it quits the yarn cylinder. With these several improvements, the process of printing yarn is greatly improved, as well as rendered more exact, uniform, and effective than heretofore.

COATING AND FINISHING LACES, BANDS, STRAPS, &c.

William Paton, *Johnstone, N.B.—Patent dated Feby.*, 24, 1861.

The patentee's improvements relate to the manufacture of laces, bands, straps, and other generally similar articles in which the surface of the article is coated, or coloured either with a coating or staining composition, which may be afterwards glazed or polished if required.

Fig. 1.

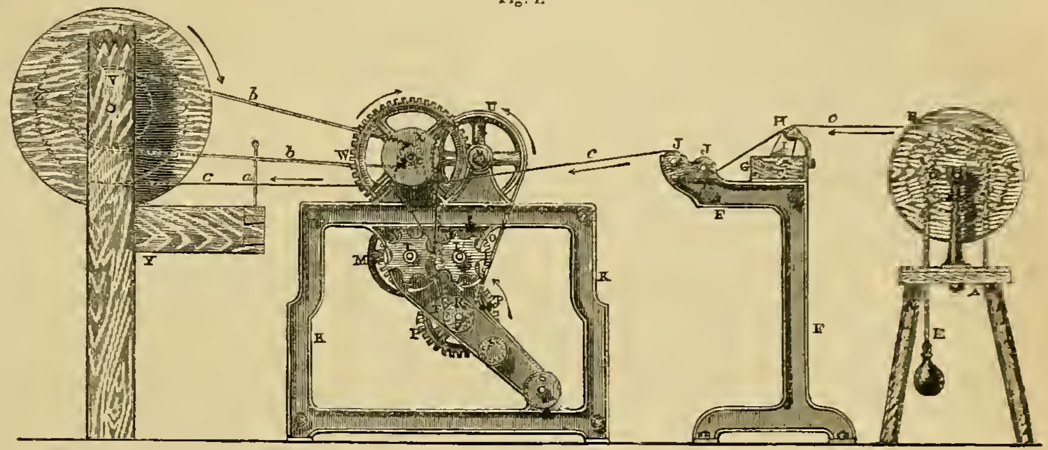


Fig. 2.

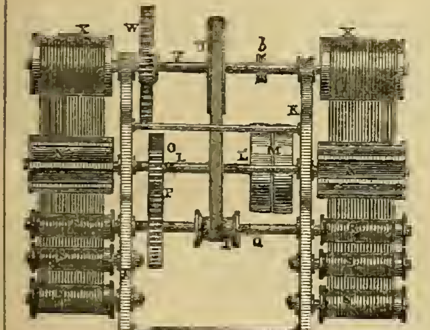


Fig. 1 of the accompanying engravings is a side or longitudinal elevation, showing an arrangement of machinery or apparatus suitable for coating or staining laces, bands, straps, and other similar articles. Fig. 2 is a plan of the polishing machine. The material for forming the laces, bands or straps is plaited or twisted to the required size or figure, by means of the machinery ordinarily used for the purpose. This plaited or twisted material is then subjected to the coating or staining and glazing processes, or a portion of these operations to complete the manufacture. The material is first wound upon a drum or reel. The framing, A, has arranged upon it two standards which support the spindle of the drum, B, upon which is wound the material, C, for forming the laces, bands, straps, or other generally similar articles. On one end of the spindle of the reel, B, is a grooved pulley, D, a cord, E, is attached to the table of the framing, A, or other convenient part; this cord is carried over the pulley, D, and has a counterweight attached to its free extremity, which serves to regulate the tension of the lace, or band, C. Arranged parallel with the framing, A, is a frame, F, formed of two end standards united by tie rods; this frame supports a trough, G, which contains a supply of the coating or colouring material. This coating or colouring material varies in its composition according to the particular purpose to which the material, C, is to be applied. Thus it may be a solution of india rubber, gutta percha, starch, or other preparation suitable for imparting the particular kind of finish or tint, according to the purpose to which the material, C, is to be applied. Projecting partly over the trough, G, is an arm carrying a stud on which are two small rollers, H. The lace or band, C, is carried over one of these rollers downwards below the roller, I, which is partially immersed in the coating solution. The lace or band, C, passes upwards from the roller, I, and over the second roller, H, and from thence under the first of a pair of tension rollers, J, and over the second one. These rollers run in bearings in the laterally projecting brackets of the frame, F. At the central part of the apparatus is placed the frame, K; in the end standards of this frame are arranged the bearings of the main or driving shaft, L, on which is the fast and loose pulley, M, deriving its motion from a steam engine or other prime mover. The extremities of this shaft extend out beyond the framing, K, and carry upon this part polishing or glazing rollers, N, which are formed with grooves or indentations in the peripheries. Parallel with the glazing roller, N, is arranged a second roller, N^1, and between these the lace or band is passed when subjected to the glazing operation. On the shaft, L, is keyed a pinion, O, which gives motion to the wheel, P, on the shaft, Q, on the outer extremity of which is the roller, R, and on studs arranged in an angular direction beneath it are two rollers, S, and S^1. The shaft, Q, has fitted to it the small band pulley, T, which gives motion to the pulley, U, on the upper shaft, V, and a pinion, V^1, on this shaft drives the wheel, W, on the shaft, W^1. The bearings of both these shafts are carried in vertical bracket pieces cast on the upper parts of the end standards, K. On the outer overhanging extremities of the shaft, W^1, are fitted the rollers, X, and the lace or band, C, is carried from the second rollers, J^1, round the rollers, X, downwards between the polishing rollers, N, and N^1, and there past the rollers, R, and S, and below the roller, S^1. From this roller the lace or band is carried upwards passing again between the rollers, N, and N^1, and over the rollers, X, and away to the drum or cylinder on which it is finally wound. In its passage through the glazing machine, the lace or band is wound a number of times round the several tensional rollers, so that a considerable length of the material is subjected at one time to the glazing operation. At a convenient distance from the glazing machine, K, is arranged the standards, Y, from which a rectangular frame projects in a lateral direction. On this frame is arranged a series of pins, *a*, forming a kind of reed which serve to guide the length or lengths of plaited or twisted material on to the drum or cylinder, Z. The spindle of this drum is carried in the standards, Y, and on one extremity of the spindle is a pulley which is driven by an endless band, *b*, carried round the shaft, V. If the plaited material which has been treated in the foregoing manner is intended for boot laces, it is unwound from the drum, Z, cut into suitable lengths, and then tagged in the usual way, or the bands, straps, or other articles are otherwise made up for sale. The twisted or plaited material, after being coated or coloured of a brown or black colour, and glazed, bears a close resemblance to leather, and may be substituted in place of the more expensive material. These boot laces are superior in point of strength, durability, and neatness of appearance to leather laces, and they are finished so as to form either a round, oval or flat lace, having a brilliant, glossy surface. It will be obvious that the machinery or apparatus for coating or glazing the plaited or twisted fibrous material may be modified in various ways to suit the particular object in view, and that smooth rollers of glass, metal, or other material, or rotatory brushes, may be made use of to effect the glazing or polishing process. This part of the operation may also be accomplished by causing the lace or band to pass rapidly through suitable dies or openings, so as to impart to the surface a smooth and glossy appearance.

BOBBINS FOR TEXTILE MATERIALS.

G. MacKenzie, *Paisley, and* J. Hamilton, *Glasgow.—Patent dated November* 24, 1860.

This invention relates to the application and use in the manufacture of bobbins, reels, spools, or holders for textile materials, of clay, porcelain, or any suitable fictile material, instead of wood, ivory, or other materials hitherto used in such manufacture.

Under one modification these bobbins or holders are manufactured wholly of clay or porcelain material. The clay, or other suitable plastic material, is prepared in the form of a stiff plastic mass, which is fed into a moulding or shaping apparatus. This apparatus is arranged in such a manner that the clay is pressed or carried forward so as to cause it to exude through a moulding aperture, or series of the same. These apertures form the clay into cylindrical lengths, which have a tubular passage extending throughout each length. This tubular aperture is formed by a piece of wire, or other suitable cylindrical material, fitted or arranged in the centre of the moulding orifice, so that as the clay exudes it forms a tubular aperture through the moulded length. As the moulded clay passes out through the aperture or apertures, it is rapidly cut into short lengths, corresponding to the length of the bobbins required. The cutting operation is effected by means of a self-acting knife or cutter, which is actuated from the moving parts of the machine. The lengths of clay are then put aside in a suitable place for the purpose of drying the clay sufficiently to admit of the barrel part of the bobbin being turned or formed to the required diameter. The turning apparatus consists of a lathe having a trough or gutter so arranged that the clay blanks may be readily passed in succession on to the mandrel. The cutting tool of the turning apparatus is arranged so as to have a self-acting traverse to and fro. In this way, when a blank is put on to the mandrel by the attendant, the cutting tool moves up to the blank and turns the barrel part of the bobbin down to the required diameter. At this point the cutter begins to move away from the bobbin, which is then removed, either by hand or mechanical means, from the mandrel. Another blank is slipped on to the mandrel in readiness to receive the cutter in its forward traverse, and in this way the forming of the barrels is effected with great rapidity and ease. The turned bobbins are next arranged in a kiln, and fired in the usual way, and on cooling they present the appearance of what is known as biscuit ware. The last operation is to glaze the ends of the bobbins, which is done in the usual manner; the barrel of the bobbin is by preference left unglazed, in order to obtain a better hold for the thread when wound thereon. Prior to the glazing process the ends of the bobbins may, if required, be ornamented with suitable devices or manufacturers' trade marks. Another mode of making these earthenware bobbins in lieu of turning them, is to form them in moulds. These moulds may be formed in two parts, which are hinged together, and made with handles so as to compress the clay forcibly into the recesses of the interior. When a mass of clay is put into the mould the simple act of shutting the mould forms the clay to the desired figure. Holes are made through the ends of the mould to admit of a wire being passed through the enclosed clay, and so form the tubular aperture through the barrel. The moulded bobbins are subsequently dried to a proper degree, and are then turned if required, in the manner before described, burnt and glazed in the usual way. Another modification or mode of manufacturing these improved bobbins is to form the ends of earthenware and the barrels of wood, tin, paper, or papier maché. These ends may be manufactured with great rapidity, either by forming them in moulds, or by punching them out of clay prepared and rolled to the required thickness; or a cylindrical length of clay, similar to what is described in the first modification, is put into the trough or guide of a cutting apparatus. Each time the self-acting cutter is raised the clay is caused to move forward a distance equal to the thickness of the ends to be formed. When this movement takes place the end of the clay comes in contact with a die or mould, which imparts to the clay the required convexity for the under side of the bobbin ends. The descent of the knife severs the moulded end, and in this way the discs are formed with great rapidity and accuracy. These discs are afterwards fired in a kiln, ornamented with designs if required, and glazed. The discs are then fitted to the wooden or other barrels, which completes the manufacture. Instead of making the barrels of a material dissimilar to the ends, the barrels may also be formed of clay if preferred. To do this, the clay is forced through a die or moulding plate, the aperture or apertures in which correspond to the diameter of the barrel of the bobbin, and having the usual longitudinal aperture formed in the clay as it exudes from the die. As the clay is moulded in this manner, it is cut off by a self-acting knife into pieces of the required length. To these pieces, as they are formed, the end pieces or discs are stuck thereto; the bobbins thus formed are dried to the proper degree, fired in the kiln, and then glazed. Bobbins manufactured according to these several improvements, combine lightness with elegance of appearance, and great economy in prime cost.

LAW REPORTS.

Embroidery Cotton: Cartier v. Westhead.—This was an application for an injunction made to Sir William Page Wood.

Mr Rolt and Mr Elderton moved, on behalf of the plaintiff, for an injunction to restrain the defendants from selling as "French cross embroidery cotton" or "cross embroidery cotton" or "cross cotton," or with labels similar to those of the plaintiff, any cotton not manufactured by the plaintiff, and also from using any labels, &c., calculated to lead purchasers to believe that they are buying cotton which has been manufactured by the plaintiff.

The plaintiff was a cotton manufacturer in the Rue St Denis, Paris, carrying on business under the firm of Cartier, Bressor, Freres. For some years he had manufactured a sort of embroidery cotton known as "cross cotton," and so termed from the figure of a cross on the labels. This cotton was largely exported, and the sale in England amounted in 1857 to 405,000f. In 1858 the sale fell to 240,000f, owing, as the bill alleged, to a quantity of inferior imitations that had been introduced into the English market. In April, 1859, the plaintiff obtained an injunction in this court against John Venables May, of 23 Canon Street, West, restraining him from using any imitation of the labels used by the plaintiff to designate his "French cross cotton." The order for the injunction was widely advertised by the plaintiff, and a copy of the advertisement enclosed in each parcel of the cross cotton. In May last the plaintiff had reason to believe that the defendants, who carried on a large business as manufacturers and merchants in Piccadilly, Manchester, were selling embroidery cotton not manufactured by the plaintiff as French cross embroidery cotton, and with labels and wrappers closely resembling those used by him. On the 30th of May Mr Henry Hill, a commercial traveller, was directed to call at the defendants' warehouse and try if he could purchase what they called cross cotton. Hill, after getting to the warehouse and opening proceedings by some trifling purchase, asked for "cross embroidery cotton." The shopman replied that he did not know what Hill meant, but that they had Brookes's. Hill said, "That won't do." The shopman said, "Can you tell me what the article that you want is like?" In the meantime the head salesman, or shopwalker, was attracted by the conversation, and came to see what Hill wanted. "Cross embroidery cotton," said Hill. Another parcel of cotton was produced "Will that do? is that what you want?" asked the shopwalker. "I am not sure whether it will do or not. It is not for myself. All I know is that I was to ask for cross embroidery cotton, as you would be sure to know what it is." The shopwalker pointed to the sample and said, "That is French cross embroidery cotton. You can get no other kind." Hill bought two gross of this cotton, and, according to the allegation in the bill, the wrappers and labels were found to bear a general resemblance to the wrappers and labels used by the plaintiff, being nearly identical in colour and with the superscription in what was termed a "hybrid" French English language, the mark, however, being an anchor, and not a cross, as used by the plaintiff, though strongly resembling a cross from the fluke of the anchor being concealed by the wrapping thread. Under these circumstances the present bill was filed to restrain the sale by the defendants, and an injunction was now applied for.

The case made by the defendants in their affidavits was that the labels upon the cotton sold by them were essentially different from those used by the plaintiff; that they had not represented their cotton as cross cotton, or of the plaintiff's manufacture, and that no purchaser had been or could have been deceived; and that in any case the term "cross cotton" was generally applied, especially in the United States, to all embroidery cotton, of whatever manufacture. They also gave a somewhat different account of the transaction in the warehouse when Hill was sent to ascertain the supposed improper use of the plaintiff's labels.

Mr E. Bury (with whom was Sir Hugh Cairns), for the defendants, opposed the motion.

The Vice-Chancellor, without calling for a reply, said that he must grant the injunction. The case was left so bare of all explanation by the defendants that as the evidence now stood he could give no weight to the allegation that they never intended to represent the goods sold by them as of the manufacture of the plaintiff. With respect to these labels, the principal difference in which was the anchor in place of the cross, and the initials "W. T." for "C B.," if it had been shown that there was any manufacturer whose name corresponded to the initials "W. T.," and that the defendants had bought these cottons from him, he being in the habit of affixing that mark to his cottons, then the case would have been different. But here the label contained the same words in the French language, and was of exactly the same coloured paper. Why, with all the colours in the world to choose from, should the defendants have taken the same colour, and that a somewhat unusual one, as the plaintiff? It might have been the custom of the trade to use that particular colour, but there was not a word of evidence to that effect. All these points of similarity which required explanation were left wholly unexplained. The question, as in all these cases, was simply this, why did not the defendants, if they wished to sell their own cotton, put their own names upon it? If they bought it of another manufacturer, why did not that manufactuer put his own name upon it, or at any rate explain why he did not. The plaintiff had established a clear and undisputed title to his manufacture of French cross embroidery cotton. He had had a very large sale for it, and in April, 1859, obtained, upon the submission of the defendant in that case, an injunction to protect his goods from imitation. That injunction was widely advertised, and upon the evidence it must be taken that the defendants were influenced by that advertisement, for after 1859 they very properly ceased to use the particular design. His Honour then adverted to the evidence, and observed that though Hill's conduct was open to the observation that he went to their warehouse to make a case against the defendants, and so far might be supposed to have a bias, yet his account of what took place was not contradicted, but, in reality, strongly confirmed, by the evidence of the defendants. He quite believed the statement that the defendants did not give out that they sold "cross cotton," but still the wrappers, &c., were made up in such a shape that what the defendants supplied would pass for cross cotton, thus supplying to others the means of deceiving the public. It was their own fault that the points of resemblance remained unexplained, and it was impossible to come to any other conclusion than that the imitation was intentional. The injunction must therefore be granted.

Purification of Gas: Hill *v.* Evans.—In Chancery before the Lords Justices.—In this case, which was reported in our last, p. 130, the judgment was reserved. The Lords Justices have since affirmed the decision of the Vice-Chancellor upon the interlocutory motion for an injunction, which was accordingly continued; but by reason of a difference of opinion between themselves upon the evidence, the hearing upon the motion for a decree was entirely thrown away; and they remitted the case upon the motion for a decree, with liberty to each party, if he desired it, to produce further evidence.

Ornamental Design: Jones *v.* Jackson—Before V. C. W. Page Wood.—Motion for an injunction to restrain the defendant from manufacturing or selling belts, or other articles, to which a fraudulent imitation of the plaintiff's registered design has been or should be applied, and generally from infringing the registered design of the plaintiff. The plaintiff, who was a brace and belt manufacturer in Aldermanbury, stated by his bill that he had invented a new and original design applicable to ornamenting the clasps or fastenings of boys' belts or other similar articles. This design, which was in imitation of a watch face, the hands forming the fastening, was registered by the plaintiff on the 31st of January last, pursuant to the 5th and 6th of Victoria, cap. 100. The defendant, who was also a brace and belt manufacturer in Aldermanbury, had recently manufactured boys' belts with a clock face fastening, which was alleged by the bill to be a fradulent imitation of the plaintiff's design.

It was contended for the defendant that there was nothing new or original in the plaintiff's design; that the defendant was fully entitled to the particular fastening designed by him, and that there had been no infringement within the meaning of the Act 5th and 6th Victoria, cap. 100.

The Vice-Chancellor refused the motion, saying that there was nothing new in the pattern of the plaintiff's ornament. It was a watch face of the most common and ordinary character. Nor was there any novelty of design in the application of the ornament to the particular class of articles, so as to entitle the plaintiff to say that, although the pattern was old, the application was new. Costs to be costs in the cause.

REVIEWS OF NEW BOOKS.

Gas Legislation; being a Copious Index to the Metropolis Gas Act, 1860, with a Commentary on the Act, and Observations on recent Gas Legislation. By Samuel Hughes, Civil Engineer. London: Waterlow & Sons. 1861. Pp. 240.

The Metropolis Gas Act of 1860 is here printed at length, accompanied by abstracts of it in various shapes, and a commentary. We should think that it is a useful volume to consult by those inhabitants of London who are interested in the law of gas companies. The author complains that there is much apathy on this subject, and that out of the whole thirty-nine boards and vestries, constituted under the Metropolis Local Management Act, probably not more than two or three are making any use of the Act here commented on to protect the interests of their rate-payers as consumers of gas.

CORRESPONDENCE.

THE MAGNETICAL DEVIATIONS OF THE COMPASS.

IV.

In the former paper, I endeavoured to show that magnetism may be reasoned upon on similar principles to that of the flow of a current. Then it would seem plain that, when we discover the set or flow of a current, we may use means to equalize that flow or set. We now come to the question, How are the magnetic currents induced? It appears clear that the induced magnetic power depends on the atomic arrangements of the mass, and that the magnetic influence may either bind or loose the atoms of matter. Induced magnetism may, for a time, react against the great natural law, but the weaker current must ultimately give way to the stronger. To induce sensitive magnetism in a bar or plate of iron, the bar or plate must be rolled or hammered in a line with the magnetic meridian; by this means we induce a sensitive current of magnetism in the bar or plate. Also, if the bar or plate be suspended in the magnetic meridian, it will acquire magnetism by induction without physical action. Magnetism may also be powerfully induced by the galvanic battery.

That we may understand this more clearly, let us suppose that we clip or twist a strip of iron in the magnetic meridian, it immediately forms a magnet. Suppose that we clip or twist a strip of iron in an easterly or westerly direction, its magnetism is indefinite to polarity, thus clearly indicating that there is no current of magnetism from east to west to induce magnetism in iron. From this we observe, that bars or plates which may be rolled, hammered, bent, or clipped, east and west, will be comparatively free of magnetism, compared with those rolled or twisted north and south. This, then, so far assists us in reasoning on the deviations of the compasses in iron ships. Then let us keep clearly in view these leading facts, that we may draw clear deductions from them. Let us first examine the magnetic condition of the iron previous to its being used in the construction of the ship.

The rolling of the iron is the finishing process, so far as the manufacturer is concerned; on the direction in which it is rolled and cut, depends the strength of its magnetic condition. The direction in which the iron is rolled may be favourable to the arrangement of the atomic mass composing it. Bars or plates rolled in a polar direction will, at all times, indicate a greater flow of magnetism. From observations I have made in large iron manufactories, I have observed that iron, during the process of rolling, acquired an amount of magnetism, the quantity of that magnetism depending upon the direction in which it has been rolled; and the magnetism so acquired is not, in my opinion, at all times destroyed during the construction of the ship. The experiments of Dr Scoresby on iron bars and plates, in reversing or changing their magnetism, demonstrate the power we possess by physical means of making the magnetic laws so far subservient to our designs in the construction of our ships; but while we keep strictly in view the utility of these experiments, we must be careful in our deductions when applying them to the building or constructing of iron ships.

On entering a building yard, we observe the furnaces for heating the plates at one point of the compass, the tables for bending and twisting at another, and the machines for punching and boring at a third. From these varied positions, we can observe ribs fixed to the ship's keel that would retain a greater amount of permanent magnetism than those hammered, bent, or twisted, in an opposite position. I have found, from close observation, when a ship was building, the magnetism running in an easterly direction, and sometimes in a westerly, acting and reacting as beam after beam was fixed, and plate after plate was riveted, thus showing that those plates and ribs which were bent and twisted near to the magnetic meridian contained a greater amount of permanent magnetism than if they had been bent or twisted in an easterly or westerly direction. Again, if the upper end of each rib, post, or pillar, in a northern latitude, forms a south pole, except where previously charged by physical induced magnetism, the lower ends of these forming north poles, the covering plates at times strengthen or weaken these influences. When the northern and southern magnetisms are permanent, and nearly balance each other, the indications of the compass are more correct, and are more easily rectified. The compasses of ships so balanced, in passing to a southern latitude, will indicate at all times more correctly than if either of the magnetisms had been predominant. This may be the reason why a few shipmasters are enabled to report favourably of the indications of their compasses in southern latitudes. I have no doubt that when this subject comes to be fully investigated, it will be found that those compasses reported favourably of, had never been much out.

Much has been said of late regarding the position in which ships ought to be built, but I know, from extensive observation, that the extreme deviations do not arise solely from the position or line in which the ship has been built, but much of it from the direction in which the ribs and plates may have been bent, clipped, bored, or twisted, also the direction in which the stern post may have been forged; for I have known cases where it was forged in a reverse direction, and a strong northern polarity was induced to the top, which greatly modified the deviations of the steering compass. To the arrangements of the machinery for bending, cutting, and boring, the ship-builder may have it in his power to construct his machinery in the most favourable position, but with the position of building he has little choice, as he must conform to the run of the water.

I know of building yards which lie in a favourable position, and the deviations of the ships built are small. This does not arise solely from the position of the ship. The bending, cutting, and boring is performed in an easterly and westerly direction. I have come to the conclusion that position is not the most essential point, as I know of some yards which are favourably situated, as regards the position of the ship, but the bending, cutting, and boring are reversed to that of the former, and the deviations were nearly three times as great, so that I am inclined to believe that the position of the ship is not so important as that of the machinery.

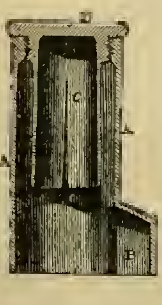
I am in possession of upwards of 200 cards of the natural deviations of compasses, and they do not bear out position as being the main point to be kept in view. I have often observed in ships having two or three compasses that their lines of no deviation were very different from one another. It is only a few weeks since two ships that were built under the same shed, and on the same lines, yet, when these ships were adjusted, the deviations in the one were double those in the other, and their lines of no deviation were equally different; this can only be accounted for by immediate local influences. I have no doubt, so far as the hull or shell of this ship is concerned, that those great natural lines may be very clearly traced; but in steamers, where there is such a quantity of iron introduced, those lines become bent out of their natural direction, and thus give to each compass a different line of no deviation; and numerous openings in the deck of a sailing ship give a similar tendency to distort the natural lines. From this we may so far reason that, if the compasses be under the dominancy of either of the polarities, the magnetic needle will be drawn towards that point; this disturbance may be equalised by a similar or opposite current. From this view of the question, we can conceive of a series of currents repelling each other, and thus so far equalising the balance of the magnetic needle, if suspended in the focus of the repelling influence; or it may be reversed by the opposite pole equalising the set of the magnetic current.

Paul Cameron.

REGISTERED DESIGNS.

COMBINED RIFLE MUZZLE STOPPER, AND SIGHT PROTECTOR.

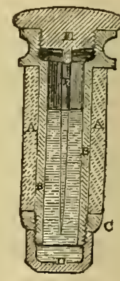
Mr James Kerr, *Superintendent of the London Armoury Company, Limited.*



The purpose of utility to which the shape or configuration of this design has reference, is the obtainment of a suitable and effective apparatus for stopping or closing the muzzle of a gun or rifle, and of protecting the sight. The accompanying engraving represents a longitudinal section of the combined apparatus, complete. A, is an outer cap or tube, which fits over the muzzle of the barrel, and is provided at one side with a small projecting chamber, B, which, when the projecting tube is in its place, fits over and protects the sight. On the end of the barrel, C, is the stopper, which is screwed into the end of the tube, A, and is contained inside. This stopper consists of a valve, which is closed at its outer end by a cap or cover, D, and has one or more splits in it longitudinally, as at *c*, for the purpose of imparting a certain amount of elasticity to it, so as to enable it to fit with tightness inside the bore of the barrel. This is a very convenient and useful addition to fire arms, and effectually protects the sight, which, in the ordinary way is very liable to accidents in carrying the gun, or in piling arms.

COMBINED MUZZLE STOPPER, OIL BOTTLE, NIPPLE PRICKER, AND RIFLE GROOVE PROTECTOR.

W. H. Blanch, 4 *Derby Square, Liverpool.*



This little *multum in parvo* is shown in vertical section in the accompanying engraving. A cylinder of cork, A, is placed upon a metal tube, B, which forms the oil-cup and pricker sheath. At the lower part of the tube, B, is a screwed collar, C, which holds the cylinder, A, in position. The tube, A, forms the oil bottle, and this is closed at the lower end by the cap, D. The upper end of the bottle is fitted with a screw cap, E, to which the nipple pricker is attached. When the tube is to be used to protect the rifle grooves, and at the same time serve as a guide for the ramrod during the cleaning of the rifle, the parts, D, and E, are removed. The cork cylinder, A, when it becomes worn is very readily removed and replaced by a new one.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

LONDON ASSOCIATION OF FOREMEN ENGINEERS.

On the 3d ultimo, at the ordinary meeting of the above society, Mr Howbridge read a paper on "A Wheel for Lifting Water and other Fluids." He wished those of his auditors who had attended at all to the matter in hand, to look back over the last half century at the methods which had been adopted in the low countries for effecting drainage. There was the old windmill, with its wooden shaft, wooden gearing, and wooden scoop wheel, scarcely powerful enough to raise water a few feet, and sometimes, perhaps when most required, unable to operate at all, either from want of wind, or too much of a "lead" to operate against. How slowly improvements had been made! The first great step in the right direction was taken by Mr Glynn, then manager of the Butterly Iron Works, by the introduction of steam power for the purpose of working scoop wheels. These last had undergone many modifications, for it was long since discovered that they did not accomplish all that might be desired of them. Mr Howbridge stated that during the years 1848, '49, '50, he was very extensively engaged in making scoop wheels for draining the fens of Cambridgeshire and Lincolnshire, and thus a consideration of the subject was, as it were, forced upon him. Observing that the wheels in use had many practical and grave defects, he had set about devising something better. After many plans had been taken up and put down, many models made and abandoned, he had come to the conclusion that the kind of wheel he should that night endeavour to describe, was among the best that could be used for the purpose of lifting water.

The objects to be attained in the construction of steam-driven wheels for lifting water were undoubtedly the raising of the greatest quantity of water to the greatest height with the least expenditure of motive power, and the least amount of waste. These desiderata were to be combined with a wheel of small diameter, which would work against a "lead" of water at the discharge, and lift most when the flood was highest. Above all, their simplicity of construction was an indispensable requirement, for there must be little liability to derangement from dirty water or such *debris* as was frequently to be met with in the courses of the fen districts. He trusted that all these points had been properly taken into account in the wheels which, by the aid of diagrams and explanations, he would describe. The reader here exhibited a sectional elevation of the wheel he had devised; it represented a bucket wheel, with hollow arms, made of sheet iron. Through these arms, which are in fact pipes, the water raised by the curved buckets during the revolutions of the wheel would be discharged into the hollow shaft or axis upon which the wheel turned. Each arm was fitted with a self-acting gravitating valve, which would open and admit the water raised to the hollow shaft or axis, and close against its egress through the arms on the opposite side of the wheel. The arrangement of these valves appeared to be simple, and yet ingenious in the highest degree. They would receive the water as rapidly as it came to them, and refuse to part with it except through the central axis, whence it might be diverted to any channel. Mr Howbridge remarked that the scoop wheel could not be made to throw water more than one-third its diameter, whilst the wheel he recommended would easily do so to the extent of *one-half*, thus demonstrating the fact that a smaller wheel would do the same amount of duty.

From calculations carefully made, he had satisfied himself that a twenty-foot wheel, on his plan, with eighteen buckets, each two feet wide and two feet deep, and making eight and a-half revolutions per minute, would lift twenty-six tons of water or other fluid per minute. This would require sixteen-horse power, or, adding one-fourth to that for overcoming the inertia of the wheel, say twenty-horse power. The reader of the paper went further into detail, with a view to proving the superiority of the hollow armed wheel over all others yet known, and urged that it was well adapted for drainage, irrigation, and sewage purposes.

THE ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS.

At the last ordinary monthly meeting of the executive committee of this association, held at the offices, Manchester, Hugh Mason, Esq., of Ashton-under-Lyne, Vice-President, in the chair, Mr L. E. Fletcher, chief engineer, presented his monthly report, from which we have been furnished with the following extracts:—

"During the past month, 239 visits have been made, 669 boilers as well as 442 engines have been examined, and the following defects discovered:—Fracture, 7; corrosion, 11; safety valves out of order, 12; water gauges, do., 11; pressure gauges, do., 15; feed apparatus, do., 4; blow-off cocks, do., 9; fusible plugs, do., 1; furnaces out of shape, 19; over-pressure, 7 (dangerous); deficiency of water, 2; boilers without safety valves, 1 (dangerous); total, 99 (8 dangerous); boilers without glass water gauges, 17; without blow-off cocks, 20; without pressure gauges, 5; without feed back pressure valves, 54.

"During the last month three explosions have come to my knowledge, each attended with loss of life; in neither case, however, have the boilers been under the inspection of this association, nor, I believe, under that of any other. I have not had an opportunity of examining any of these boilers since their explosion, but have been informed that two were of ordinary Cornish construction, one of which failed from deficiency of water. The third was of the tubular locomotive class, and the explosion arose from thinning of the plate just behind one of the laps situated in the cylindrical part of the boiler, and below the water line. I have known this to occur to stationary boilers, apart from corrosion, as caused by blowing joints or external damp, and attribute it to disintegration of the plate, consequent on the constant buckling action which is induced in close proximity to single lines of rivets by heavy strains. The constant occurrence of explosions from weak places in plates, entirely unsuspected and only ascertained by a *post mortem* examination as it were, shows the imperative necessity for laying bare the plates of all boilers which have been in work for any length of time, and having a faithful and most searching examination made of them on both surfaces. A boiler is too apt to be considered in a state of rest when once it is fixed on its bed, whereas the fact is, that directly the fire is lighted all the parts are set in comparative movement one with the other; every fresh charge of coals expands the plates of the furnace tubes; every draught of cold air through the furnace door contracts them; while the varying pressures of the steam and any irregularity in the introduction of the feed water, more especially if cold, change the shape of the shell, so that the boiler is in a constant state of respiration, which must in course of time have an influence upon it.

"This shows the importance, in the first construction of boilers, of having all the cylindrical parts truly circular, and without any flat places in them, so as to prevent constant alternate buckling action, while it appears to me to point to seams of double riveting as more enduring than single for continuous heavy strains; also, that in estimating the safety of boilers, time must always be considered as an element, and that nothing can be more fallacious than to argue that a boiler must be safe at a given pressure, because it has stood it for several years."

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The thirty-first meeting of the British Association for the advancement of science will commence in Manchester on Wednesday, the 4th of September, 1861, under the presidency of William Fairbairn, Esq., LL.D., F.R.S. The General Committee will meet on Wednesday, the 4th of September, at 1 p.m., for the election of sectional officers, and the despatch of business usually brought before that body. On this occasion there will be presented the report of the Council, embodying their proceedings during the past year. The General Committee will meet afterwards by adjournment. The first general meeting will be held on Wednesday, the 4th of September, at 8 p.m., when the President will deliver an address; the concluding meeting on Wednesday, the 11th of September, at 3 p.m., when the Association will be adjourned to its next place of meeting. At two evening meetings, which will take place at 8 p.m., discourses on certain branches of science will be delivered. There will also be other evening meetings, at which opportunity will be afforded for general conversation among the members

The Committees of Sections will meet daily, from Thursday, the 5th of September, to Wednesday, the 11th of September, inclusive, at 10 a.m. precisely. The Sections will meet daily, from Thursday, the 5th of September, to Tuesday, the 10th of September, inclusive, at 11 a.m. precisely. The following are the titles of the Sections to which communications may be presented:—

Section A, Mathematics and Physics.
" B, Chemistry and Mineralogy, including their applications to Agriculture and the Arts.
" C, Geology.
" D, Zoology and Botany, including Physiology. Sub-section D.

Section E, Geography and Ethnology.
" F, Economic Science and Statistics.
" G, Mechanical Science.

Notices of communications intended to be read to the Association, accompanied by a statement whether the author will be present or not at the meeting, are to be addressed to Prof. Phillips, M.A., LL.D., F.R.S., Assistant-General Secretary, University Museum, Oxford; or to R. D. Darbishire, Esq., B.A., F.G.S., Alfred Neild, Esq., Arthur Ransome, Esq., M.A., and Prof. Roscoe, B.A., Local Secretaries, Manchester.

The local Sub-Committee of section A, intend to get up an exhibition of telegraphic machinery illustrating its gradual development. They have accordingly asked for contributions of instruments, batteries, &c., and they hope to be able to show many interesting examples of telegraphic contrivance. The practical working of various instruments will be illustrated by opening communications on one evening to the principal cities of Great Britain, and the Continent.

MONTHLY NOTES.

MARINE MEMORANDA.

Dockyard Extension.—The Select Committee on the proposed extension of Chatham Dockyard have reported to the House of Commons that there is not at present in this country a sufficient extent of floating basins or dry docks, especially for the larger class of ships; in 1830 the largest vessels did not exceed 245 feet in length, but they have now reached 380 feet, and the construction of a ship of 400 feet is in immediate contemplation; the draught of water has extended to 27 feet, causing a complete change in the whole system for which our dockyards were originally constructed. Hence even now in time of peace much delay, risk, expense, and inconvenience have to be incurred in fitting out in the stream—a practice which is prejudicial to the service and unnecessarily exposes the crews. In the event of a maritime war it would be wholly impossible for us, with the existing means, to equip rapidly and safely such a fleet as would then be required. The facilities possessed by other Powers for fitting out ships of war are incomparably superior to ours. We have in England 40 acres of floating basin; in France there are, or soon will be, 260. It was stated to the committee that until this moment (one being just finished at Portsmouth) we have not had a dock that would take in the Warrior; the French have four at Cherbourg alone. Nor can any reliance be placed in the docks constructed for the merchant service; with perhaps one exception they all fall far short of the requirements in depth of water. The engines of the Royal Navy have been nearly doubled in the last seven years, and now amount to about 130,000 horse-power; as these come to require repair the existing basin and dock accommodation must be found wholly inadequate even in time of peace. Rear-Admiral Robinson, Controller of the Navy, observed in his evidence before this committee, "After a naval engagement the country that can first repair its ships damaged in action will thereby double its force." The committee were assured that the requisite depth of water in the Medway can be secured; that the cost of forming the channel would not exceed 40,000*l.*, and the annual cost of maintaining it would not be above 1,000*l.* a-year, and that the channel may be formed in six years. The site proposed to be taken is far removed from danger of being shelled by hostile ships of war, and is protected by the fortifications which form part of the system of national defences. The committee recommend, therefore, the proposed extension of Chatham dockyard as the best and most economical mode of increasing the existing accommodation for the fitting out and repair of the ships of the Royal Navy.

Submarine Telegraphs.—In 1859 a joint committee was appointed by the Board of Trade, and by the Atlantic Telegraph Company, to inquire into the construction of submarine telegraph cables. Their report was recently presented to both Houses of Parliament, and has been printed as a blue book of 564 pages Thirty-eight witnesses were examined, whose evidence has been printed at length, and contains much valuable information on this interesting subject. The report is divided into three heads. The first gives an account of the 11,364 miles of submarine cable that have been laid in various parts of the world, of which, however, scarcely more than one-fourth is at work. The second relates to the construction and laying of these cables; and then, lastly, we have a summary of the principles which ought to be attended to in future undertakings of the kind. A good deal of space is occupied by the Atlantic Telegraphic Cable, as might have been expected. The failure of that enterprise is distinctly attributed to the original design of the cable having been faulty, to the absence of experimental data, to the manufacture having been conducted without proper supervision, and to the careless handling of the cable after its manufacture. They conclude this branch of their report by saying that all the failures which have occurred are traceable to defined causes which might have been guarded against, and they express their belief that there are no difficulties attending the laying of submarine cable, and the maintaining them when laid, which skill and prudence cannot overcome. A great mass of practical details is given in the subsequent parts of the report, and the whole is strongly recommended to the perusal of those interested in the subject.

Ransome's Steam-Thrashing Machine.—The leading machine now made by the Messrs Ransome of Ipswich is their patent finishing steam-thrashing machine, suitable for an eight-horse-power engine. The whole of the framework is prepared by machinery, all the scantling being sawn, planed, morticed, and tenoned by steam power machinery, and a marvellous solidity and precision of work being thereby secured, entirely superior to anything that can be done by hand labour. There are also three several patents embraced in the machine, all of which tend to make it perform its work with very little power, and to give it remarkable durability, viz., the patent shaker, the patent drum, and the patent screen, each of which we shall attempt briefly to describe. The machine itself stands on four road wheels, and its general apppearance is light and symmetrical. The front road wheels are carried on a ball and socket joint, which enables the machine to be placed on uneven ground without wringing or twisting the frame work. The thrashing drum is composed of a series of beaters, each of which consists of a bar of iron formed into a triple-threaded screw, each alternate one forming a right-handed, and the intermediate one a left-handed screw. This gives not only a channel-beater which has a perfect rubbing action in no way detrimental to the grain, but permits the beater to be reversible; for when by use the grooves are worn out on one face, the drum is so arranged that by slackening the clips which hold them, each beater can be turned partly round, and a perfectly new face exposed for thrashing. After the straw leaves the thrashing drum it passes on to the shaker, all the movements of which are rotatory, and which performs the three separate operations of removing the straw to the end of the machine, of separating from it any straw which may have escaped separation in the drum, and of carrying back all the short straws and chaff which are hanging in it to the winnowing apparatus which is placed immediately under the drum. In machines with reciprocating or crank shakers, these operations require what is commonly known as a jog board, and which, with its heavy reciprocating movements, absorbs a good deal of power, and causes wear and tear, which in this machine are entirely avoided. The thrashed corn and short straws, &c., pass on to a coarse riddle, and afterwards on to another riddle, during which time they are subjected to a suitable regulated blast of air which, together with the action of the riddles, separates the grain, the chaff, the short straws, and the chobs, into four divisions. The clean grain is then carried up by elevators through a chob-cleaner, which removes any husks that may be still adhering to the grains, and then it passes through an arrangement of sieves combined with a blast precisely similar in action to those of a well constructed hand-winnowing machine. By this process all seeds and dust are removed, and only one more operation has then to be performed, namely, the separation of the corn into various sizes by the removal of the light or chicken corn from it. This is effected by means of a patent corn screen, which may be made finer or coarser at the pleasure of the user, and which by its construction being perfectly self-cleaning is uniformly effective. Previous to the invention of this screen this was a difficult process, inasmuch as the screens hitherto in use either soon became stopped up with grain which was nearly but not quite large enough to pass through them, or they required to be kept clean with brushes revolving inside, or with washers or pickers passing between the wires, each of which contrivances involved loss of power, and was subject to continual derangement through wear. This screen overcomes these difficulties in the most simple and mechanical manner. If our readers will fancy two lengths of wire, each wound on to a cylinder of a different diameter so as to form a screw, and then this thread being supported in such a way that the cylinder could be removed from the inside so as to form two open wire spirals, one smaller than the other, and let them then fancy the smallest of these spirals mounted on a spindle and placed inside the larger one, but in such a position that the centre of revolution of the small and the large one were not identical, they will then get an idea of the construction of this screen. The two spirals being mounted as above described, and with an arrangement which permits of the centre of the smaller one being placed either concentric or eccentric to that of the larger one at pleasure, and both set in motion, it is evident that the screen will be finer at one end of any given diameter than it is at the opposite end of the same diameter, and the finest part being placed at that part to which gravity naturally carries the grain, it is evident that the centrifugal motion, by the revolution of the cylinders, will keep the screen thoroughly alive, and any grains which stick fast at the bottom will, as they pass round towards the opposite end of the diameter to that at which they stuck come to a wider place, and consequently be liberated and fall down again amongst the other grain which is being screened, so that the screen becomes by its very nature perfectly self-cleaning and free from all those accidents which have hitherto made screens so difficult to use.—*The Ironmonger.*

London.—The Select Committee appointed by the House of Commons to inquire into and report upon the local taxation and government of the metropolis have lately issued their report. 360,237 inhabited houses, with a population of 2,803,034 persons, upon 78,029 acres. This was the field of inquiry. The assessment amounts to £12,450,416, and 7000 persons are employed, entirely or partially, in duties connected with the local government of this vast body. Schemes were suggested to the committee for a comprehensive system of municipal government of the whole metropolis under one head, with minor local affairs administered by the authorities of the several wards or districts, and the report as framed by Mr Ayrton pointed to an enlargement of the city corporation, or "an improvement of the constitution of the Metropolitan Board of Works," but the committee struck out these clauses, and, observing that the question involved Imperial as well as local interests of vast magnitude, reported that they conceived the discussion of these plans should form the subject of future inquiry, and they therefore wished to express no opinion as to the comparative merits of the schemes suggested in the evidence taken. Of the Board of Works the committee say that the tendency of the evidence leads to the conclusion that though this body, as now constituted, is fully competent to discharge the duties imposed upon it, greater authority would attach to its deliberations were its members elected directly by the ratepayers, and not by the vestrymen. The committee, after recalling, among other things, the suggestion made years ago that the railway termini should be connected with each other by railway, so as to take all through traffic off the streets, recommended that the Metropolitan Board of Works should be empowered to appear before railway committees, when necessary, to watch over metropolitan schemes and protect the interests of the inhabitants. A clause recommending that the planning and execution of the Thames embankment be intrusted to this Board was rejected on a division. On the subject of taxation, the committee recommend that so far as the tax on hackney-carriages exceeds that of the country, it should be remitted or applied in aid of the rates levied for local purposes (the object for which it was imposed); that the duty on corn ought either to be abolished, or, being levied on all the inhabitants, applied for their general benefit; that, as railways and omnibuses will now compete, the taxation ought to be on the same principle, in both instances on the miles run, or in both on the gross receipts; and that the unappropriated part of the duties the city was authorised to raise, now constituting the London Bridge Approaches Fund, ought to be applied for the benefit of the inhabitants of the whole metropolis, whose taxation has redeemed the permanent annuity which the city was to pay in discharge of its own debt. With regard to the administration of justice, the committee think it deserves consideration whether the Central Criminal Court should not sit as often as might be requisite for the trial of minor cases, reserving the more important for the monthly attendance of the judges. They see no reason why the county court system should not extend to the city; and they think it matter for consideration whether it would not be advantageous to the inhabitants if arrangements were made for the trial of all metropolitan causes (not cognizable by the County Courts) at a central court of Nisi Prius, analogous to the Central Criminal Court, instead of some being tried at Guildhall, some at Westminster, and some at the Surrey and Kent Assizes.

Pneumatic Despatch Company.—The report of the directors of this company states, that extended experiments have established to the satisfaction of the engineers of the company the efficiency of the system proposed for the adoption of the company. The last experiments have been carried on with a portion of the tube and a set of apparatus prepared for the line from the General Post-office to Bloomsbury, and have resulted in proving the complete sufficiency of the disc arrangement for producing the power, as well as in showing that the power may be conveniently and economically applied. The directors, therefore, now that the trial of the full sized tube has shown the efficiency of the plan, have at once placed themselves in communication with the Post-office, the railway companies and other parties, with a view to arrangements for the immediate construction of the first section of their works. The directors hope that the original plan of commencing the works from the Post-office to Bloomsbury, and thence to the London and North-Western Railway, will be carried out, but they are anxious before committing the company to any serious outlay, and to the precise line of their first operations, to obtain a guarantee, or such arrangements for traffic, as will secure even this first section being remunerative. The extension of the works, to comprise the entire parcel delivery of London, must speedily follow; but the shareholders will appreciate the object the directors have in view of obtaining practical experience upon a limited scale, before the extended expenditure of capital shall be incurred. Messrs Rammell and Clark, the company's engineers, state in their report that the trial experiments which have been carried out both in public and private, have fully confirmed the anticipations expressed in their report upon the preliminary trials on a smaller scale at the Soho works, near Birmingham. Single carriages, and trains of carriages, of weight varying from one to three tons have been successfully passed through the tube, or portions of the tube, at speeds varying from 15 to 40 miles an hour, under pressures ranging between 1 oz. and 6 oz. per square inch, only; and these experiments have been repeated from day to day with uniform results. They find the transmission of the power from end to end of the tube to be apparently instantaneous, the buffing and delivery of the trains to be under perfect control, and, generally the combination to possess an elasticity in its working which is all that could be desired. As regards economy of power they have no doubt it will be found that a fair per-centage of useful effect is obtained, while in respect to the much more important consideration, convenient application of power, the advantages of the medium employed are too obvious to need remark. On the whole, they are fully satisfied with the results obtained, and are convinced that the company possesses in the new system a means of transmission which, from the great facilities it affords, must soon come into extended practical use.

Registrar-General's Report.—The Registrar General for England has issued his report for 1859.—Taking the average of 22 years there is one death in a year to every 45 persons living, one birth to every 30, one person married to every 61. Of the marriages at church in the year 1859 those by banns were to those by license as 5·296 to 1; and these may be taken as the proportions of the marriages of the higher and middle classes and of the artisan and other classes respectively. But of the 167,723 marriages, 31,713 were not celebrated at church. Of 100 men marrying, 14·10 were widowers; of 100 women marrying, 9·07 were widows. Of 100 men 6·20, and of 100 women 19·10. were minors. These proportions increase year by year; 20 years ago, in 1841, they were only 4·38 and 13·29; they are greatest in Staffordshire, Durham, and some of the South Midland Counties, where there is profitable work for young persons. Happily, there is also a constant increase in the proportions who are able to sign their names on the marriage register; in 1859 the proportion of men who signed by mark was only 26·7 in 100 marrying, and of women 37·6; in 1841 the proportions were 32·7 and 48·8, so that six per cent. more men and 11 per cent more women now write their names. But in Staffordshire, even in 1859 the proportions that could not write were no less than 41·7 and 53·2, and in Lancashire 55 per cent. of the women who married signed only by mark. Of the births we learn that 44,751 children, 6·5 per cent. of the children born alive and registered, were born out of wedlock; but as we lately mentioned, allowing for unregistered births, the real number is larger, and is probably from 8 to 9 per cent. of all the children born alive. To every 100 women living of the age 15-45 there were 14·9 births in the year, and this proportion is slightly increasing; in 1841 it was only 13·4. The women who bore children in the year were 15·2 of every 100 women (of that age) living. Of the deaths of 1859 we find that the rate in the chief towns was 2·386 per cent., in the small towns and country districts 2·091; the former rate was below, the latter above the average. Of every 100 male children under five the mortality was 7·389 per cent., of 100 female children 6·665—rates higher then the average. At the close of 1859 the aggregate number of names on the register of births, deaths, and marriages, which commenced in 1837, was 28,064,538. The original registers are kept by the superintendent registrars, but certified copies are sent up to the general register office, where they are indexed, and 5,052 searches were made in 1859. The public can also search the registers in the country.

Grand Trunk Railway of Canada.—The Commissioners appointed by the Government of Canada to inquire into the management of this railway enumerated in their report seven specific defects which must be remedied before the line can be put into a position to be worked with success. These defects are—1. The condition of the permanent way on the Central and Eastern divisions is largely defective, and will require extensive repairs. 2. Additional sidings, at a cost of £10,000, are immediately wanted. 3. Storage room at way stations, at a cost of £9200, is also immediately wanted. 4. The distance of the station from the city of Montreal is, the Commissioners say, "the greatest defect of the line," and they recommend an expenditure of £40,000 to remove the evil, adding that "there is some hope that the public spirit of Montreal may relieve the company of some part of the expenditure." 5. For the development of the grain traffic the Commissioners consider that "elevators" and grain stores at Toronto, Montreal, and Portland appear indispensable, and they estimate the cost at £60,000. 6. Improved wharfage at Quebec, to cost £20,000, the Commissioners consider to be desirable, but not of such pressing importance as some of the other improvements. 7. An estimate of £283,000 has been laid before the Commissioners as the cost of necessary additions to the rolling stock; but they are of opinion that while more rolling stock is doubtless required, it will be the wisest policy to make progress with the other improvements suggested, before making any considerable addition to the stock of cars, &c. Mr Watkin, the general manager of the Manchester, Sheffield, and Lincolnshire Railway was selected as a proper person to be intrusted with the entire supervision of the affairs of the company in Canada, and especially to conduct the negotiations with the Government. This gentleman left this country a few weeks ago to fill the office to which he was appointed. It is to be hoped that he will succeed in restoring some sort of order where such dire confusion has hitherto reigned.

The Balance of Trade.—The excess of our imports over our exports during the last seven years is shown by an official return to have been as follows:—

Year.	Imports.	Exports.	Excess of Imports.
1854	£152,389,053	£115,821,092	£36,567,961
1855	143,542,850	116,691,300	26,851,550
1856	172,544,154	139,220,353	33,323,801
1857	187,844,441	146,174,301	41,670,140
1858	164,583,832	139,782,779	24,801,053
1859	179,182,355	155,692,975	23,489,380
1860	210,648,633	165,670,653	44,977,990

The exports of gold and silver bullion and specie from the United Kingdom in the same period were:—

Year.	Gold.	Silver.	Total.
1854	£16,552,845	£6,033,723	£22,586,568
1855	11,847,213	6,980,965	18,828,178
1856	12,038,299	12,813,498	24,851,797
1857	15,061,500	18,505,468	33,566,968
1858	12,567,040	7,061,836	19,628,876
1859	18,081,139	17,607,664	35,688,803
1860	15,641,578	9,893,190	25,534,768

It appears from these figures that the excess of imports over exports during the seven years was £231,681,875, and that the shipments of bullion in the same period were £180,685,958, or 77 97 of the surplus. Complete returns are not yet available with regard to the proportions, foreign and colonial, of our exports in 1860, but taking the six years ending 1859, it appears that the excess of our imports from over our exports to foreign countries was altogether £181,665,900, while the colonies showed a similiar excess of £6,118,985, making a total of £187,784,885. The colonial imports and exports, it will be observed, are, upon the whole, pretty well balanced. In fact, the excess of £6,118,985 would not have existed at all but for the disturbance of the Indian trade in 1857 by the disastrous mutiny of that year.

The Pig Iron Trade.—A recent return of the shipments of Scotch pig iron again affords evidence that the trade, which in the months of April, May, and June exhibited an extraordinary degree of activity, has received a decided check. It will be interesting to note the course which shipments have taken during the present year from the 1st of January to the 27th of July. In the first six months of 1861, as compared with 1860, the following results appear:—

	1861. Tons.	1860. Tons.
Month ending January 26	31,519	32,454
" February 23	29,738	25.278
" March 30	42,554	46,928
" April 27	62,622	50,585
" May 25	65,637	54,488
" June 29	73,600	52,925

The totals for the first six months were 305,670 tons in 1861, and 262,658 in 1860, showing an increase of 43,012 tons. In July the shipments have been as follows, as compared with the corresponding month of 1860:—

	1861. Tons.	1860. Tons.
Week ending July 6	12,970	11,603
" July 13	12.077	7,133
" July 20	11,278	14,400
" July 27	11,978	14,710

Thus, notwithstanding the check observable during the past fortnight, the shipments in the month ending the 27th ult. reached a total of 48,304 tons, against 47,846 tons in the corresponding four weeks of 1860, showing a further increase of 458 tons, the total shipments this year having been 353,974 tons, as against 310,504 tons in 1860.

The Leather and Shoe Manufacture at Kendal.—The manufacture of leather is part of the industrial history of Kendal, and it still adheres to the town, but in a different phase from that which it presented a century and a half ago. In 1683 the inhabitants, petitioning Charles II. for a renewal of the Charter, state that "the trade in leather was grown very considerable," and such as might then be desired "to take toll thereof." "In 1724," says Wharton, "the companies of tanners and tanners have, at this day, so great a share of trade as enables them to pay to the Crown, by way of duty, between £1600 and £2000 per annum; and at the last Kendal Guild, in 1759, it is recorded that there were sixty tanners in the procession who had the arms of their trade painted in the front of their caps, and were attended by "bold Arthur a-Bland," properly dressed. The tanners and curriers of those days were occupied in producing the heaviest and strongest descriptions of leather, and the same manufacture is continued at the present day in limited degree. But within the past two or three years a new branch of the trade has sprung up which, in extent and importance, outrivals the old branch of the leather business in Kendal, and has struck a "heavy blow and great discouragement" to shoemaking by hand in Northampton and Stafford, towns formerly noted for the production of shoes. This new trade is carried on at Netherfield by Messrs Somerville Brothers, who employ in their establishment between 250 and 300 hands, male and female; but the greater number females. The hands are occupied principally in preparing the "work" for the sewing machine, each sewing machine requiring only one operator, and the work consists solely of making what are technically called "uppers," that is, the upper part of a boot or shoe ready for the sole. The leather used for the purpose is imported, and is almost all of fine quality. The only operation remaining for the shoemaker is to attach a "sole" to the "upper" here produced; and we are told that these latter are in some cases sold for less money than would be paid in wages for making them by hand apart from the cost of leather.—*C. Nicholson's Annals of Kendal.*

Enamelled Street Tablets.—We had occasion some time back, to notice, in terms of well deserved commendation, the productions of the Patent Glass Enamel Company at Birmingham. Among other highly useful articles which the company have produced, are enamelled street tablets; also, tablets for indicating the position of the fire plugs, and for railway stations, as well as name plates for counting-houses, warehouses, waggons, &c. These plates are formed of wrought iron, glazed with the patent enamel, the natural colour of the metal showing a rich dark ground through the siliceous coating, and thus forming a deep and effective contrast to the bold block letters, which are of a pure white enamel. A highly important advantage attending these plates, is the conspicuousness of the letters at night, the highly polished surface of the letters reflects sufficient light to make the inscription distinctly visible. But, in the ordinary plates where black letters are put on a white ground, the reverse is the case, for the ground then reflects light, whilst the inscription absorbs it, and is thus rendered illegible. The enamelled plates are moreover unaffected by rain or frosty weather; the glass coating may indeed be said to be indestructible. At the same time these plates do not offer any temptation to the thief, because the glass coating renders the metal useless for ordinary purposes; hence, the marine store dealer will not buy them even if offered for sale. We are glad to see that these plates have been adopted Manchester and other large towns, and are also about to be adopted in London, for at a recent meeting of the City Commission of Sewers, held at Guildhall, Mr James Hunt, of the firm of James Hunt & Co., King Street, Cheapside, exhibited specimens of the tablets to the Commissioners. The court expressed its high approval of the specimens, as well as the advantages attending their use, and it was resolved to bring them into immediate use in the city.

Death from Clothes catching Fire.—Considering the number of fatal accidents which have occurred to ladies, it is extraordinary that they do not universally insist on their laundresses employing some means of rendering their dresses non-inflammable. Can they be aware that if a small quantity of sulphate of soda (Glauber's salts) were dissolved in the starch, the dress would be rendered incombustible, at a cost of about one tenth of a farthing per dress? They may easily satisfy themselves of the efficacy of this cheap and simple method of ensuring themselves against a horrible death, by taking two pieces of linen, steeping one of them in a solution of the sulphate of soda, drying it, and then submitting both to the flame of a candle. On the one the flame will have no effect, whilst the other will be immediately consumed. The subject was investigated by two skilful chemists, Messrs Versmann & Oppenheim, who showed that the best results in rendering textile fabrics non-inflammable were obtained with a solution of sulphate of ammonia or tungstate of soda, and that neither solution injuriously affected the fabric or its colour. For laundry purposes the tungstate of soda was found most suitable as it does not in any way interfere with the process of ironing. If a seven per cent. solution of sulphate of ammonia, or a twenty per cent. solution of tungstate of soda be employed, the fabric cannot be set on fire. It will char with heat, but it will not inflame.

Grand Trunk Railway of Canada.—The Canadian Government Commissioners estimate that the railway and its equipments have cost £11,361,634, while there has been raised on shares and bonds £12,347,048. During the two years and a half ending June, 1858, the railway did not pay the expense of working and maintaining it, exclusive of rents and interest. Assuming the great asset, the railway, to be worth what it has cost, and that there are no bad debts among the other assets, it would appear that the total loss up to the 30th of June, 1860, had been £2,720,630. The total liabilities of the company to the 30th of June, 1860, as estimated by the commissioners, amount to £14,534,245, including £12,347,048, share and debenture capital, £1,401,339, loans from bankers, &c., £508,679, bills outstanding, £109,250, interest overdue, £16,792, rents overdue, £8,037, sundry creditors, and £143,100, sundry disbursement accounts. The total assets amount to £11,817,615, including £11,361,634, expenditure on capital account, £48,545, Portland sinking fund, £31,650, cash, £82,192, Toronto debentures, £156,787, outstanding traffic accounts, £95,992, stores and fuel, £24,566, sundry debtors, and £16,249, sundry disbursement accounts: showing a total deficit of £2,716,630, which consists of £383,099, discount, £16,697, preference capital expense, £26,005, exchange and commission, and £2,290,830, charges on revenue to the above date.

British Wool.—Although there has been an immense increase in the importation from foreign countries and the colonies during the last 20 years, the rearing of sheep for the production of British wool continues to be one of the most profitable branches of our industry. Within the period referred to there has been, no doubt, in the imports from Spain and Germany a diminution of about 4,000,000lb., but at the same time, there has been an increase from Russia, the Low Countries, Denmark and Portugal of no less than 20,000,000lb. There has been an increase within this period, in round numbers from Australia of from 13,000,000lb. to 54,000,000lb., from South Africa of from 1,000,000lb. to 14,000,000lb., from the East Indies of from 4,000,000lb. to 14,000,000lb. At home the increase in the amount of wool produced was equally remarkable. Since 1842 there has been an augmented supply of home grown wool to the extent of nearly 75 per cent. It had not been followed by any diminution of price to the home producer. Now, the countries in which the production of wool is likely to increase most rapidly—viz., Australia, the East Indies, South Africa, and South America, are all unsuitable to the production of the lustrous long wools, for which there is a great demand. The British islands supply this wool in the greatest quantity. They may be almost said to have a monopoly of it, and there are no countries which can enter into competition with them.

Electric and International Telegraph Company.—Total revenue for the half year exceeds that of the corresponding period to the extent of £1,527. The expenditure has been increased by the additional business and by Parliamentary expenses, but the nett profits are £33,733, and the directors are enabled to recommend a dividend of £3 10s per cent., and to carry forward a balance of £4,757, out of the clear profits of the half-year. This balance will be added to the renewal fund, which will then amount with interest to £41,117. The cables have worked well during the half year, and have been free from casualty. The company have been called on to carry out a variety of minor extensions for railway companies, and the directors have entered into arrangements with the West Midland Railway Company to place the telegraph on the Severn Valley and Worcester and Hereford lines For nearly eight years the company has been in litigation with reference to the original concession, by which the submarine cables were laid to Holland. After careful deliberation and much negotiation, a final settlement of every demand, and all the contingent costs, in the Dutch and English courts was effected for £5,420. The settlement relieves the company of the only liability that attaches to it.

Pimlico Railway.—The report of the Directors states that the company are now in a position finally to complete their arrangements with the Brighton Company, and on the seal of the company being affixed to the deed of conveyance the 45,000 shares held by the Brighton Company in this undertaking will be cancelled. The capital being now fully paid up, it is proposed to convert the shares into stock. The report of Mr J. Fowler, the engineer, states that the permanent way and general works of the railway have been maintained during the last half-year in excellent condition. The bridge over the river Thames has never required the smallest expense for its maintenance, and has not been affected in the slightest degree by the traffic passing over it. The contract for the permanent station buildings has been let to Mr Kelk for a sum within the amount of 105,000*l*., which the Victoria Station Company have undertaken to provide. The permanent station is to be ready for use by the 1st of April, 1862. The capital account showed that 880,260*l*. had been received, and 885,267*l*. expended, leaving a balance of 27,992*l*. The revenue account to the 30th of June showed that 12,329*l*. had been received, and 3,315*l*. expended, leaving a balance of 9,013*l*.

Belfast.—The population of Belfast 100 years ago, in 1760, amounted to 8,600 souls; in 1831, 30 years ago, it amounted to 48,224; and in the year 1861, it amounts to 119,200 souls. Nor has wealth been left behind population. In the valuation for local assessment, the fixed capital in building and other rateable property in Belfast was in 1836 £115,000; in 1861 it has risen to £305,000. History bears record to the efforts of successive Viceroys, from the Earl of Stafford to the Earl of Clarendon, to advance the linen manufactures of the North of Ireland. Probably the moisture of the climate is more favourable to the production of flax than of other cereal growths. Last year there were exported from Belfast upwards of 65,000,000 yards of linen, valued at about £2,000,000 sterling, and at the same time yarns and threads to the amount of 3,000,000lb., valued at £764,000. The improvements which have been effected in the noble harbour of the town have amounted within 20 years to half a million of money, and this without any aid from public grants; and within the same comparatively short period the tonnage of vessels and the harbour receipts have been much more than doubled.

Accidents on Railways.—During the eight months preceding the 1st of March last, 54 disasters occurred on railways, 29 of which were occasioned by collisions, 9 by the engines or carriages leaving the rails, 8 by the fracture of wheel tires, 1 by the breaking of an axle, 1 by the breaking of a wheel, 1 by the giving way of the cast iron girder of a bridge, (on the Midland railway, near Ambergate,) and 1 by the giving way of a wooden viaduct on the Whitehaven railway. In most cases the collisions occurred from carelessness or neglect of proper precaution. The employment of superior brake-power to the old-fashioned plans in use, would materially lessen the accidents arising from collision. On some of the occasions when carriages left the rails the accidents were brought about by the tightness of the gauge at curves on the line; and the want of consolidation of the permanent road occasioned other accidents of this kind. Tires ought not to be fastened on with rivets, for in the majority of instances of fracture it occurred at the rivet holes. Several plans have been proposed for fixing on tires without making rivet holes, and railway companies ought to adopt some of them.

Water-Works, Barbadoes.—The water-works at Bridgetown, Barbadoes, were completed on the 1st of June, 1861, (the water having been introduced some weeks before) in little more than 12 months after the first pipe was laid. The water is brought from a distance of 14 miles to a covered service-reservoir of 1,000,000 gallons, and distributed by about 18 miles of mains and service pipes to the city. The service is constant high pressure by gravitation, and jets from the hydrants rise 80 feet. The hydrants are 460 in number, and are fixed at the distance of about 50 yards apart in all the streets and alleys of the town. There are 105 standposts in the streets, from which the inhabitants may take water for domestic use without charge, the Legislature paying the company 5,000*l*. a-year for this service. The poorer inhabitants derive great benefit from this supply. The cost of construction is about 70,000*l*. of which more than 50,000*l*. was raised on the island. These works have been executed by a company under the superintendence of Mr J. W. Clarke, resident engineer.

Brazilian Railways.—The first section of thirteen miles of the San Paulo Railway is formed, and about four miles of the permanent way has been laid. On the second section, 37 miles in length, it has been determined to lower the levels on the inclines, and form the line in the ordinary way, with cuttings and embankments. The contractors have made rapid progress with the earthworks. After passing the summit the line runs in a valley all the way to San Paulo with works of a very light nature. The work on the inclines is the key to the whole. On the third section, 38 miles in length, a distance of about four miles from San Paulo to the Tiete river has been formed to facilitate the transit of materials. From 1,500 to 1,800 men were employed on the works at the date of the last advices. On the 13th of last June, the sum of £314,431 had been expended in the formation of this railway. It is expected that the Bahia and San Francisco railway will be completed twelve months earlier than was at first proposed.

The British Mint.—During the year ending December, 31, 1860, 21 tons of gold were coined into 2,555,958 sovereigns, and about 5 tons were coined into 1,131,500 half sovereigns. Of silver money there were coined 635,580 florins; 1,671,120 shillings; 1,100,880 sixpences; 3,410,088 threepences; and 159,088 three halfpenny pieces, for Ceylon. Queen's maunday money, consisting of silver pieces from one penny to four in silver, there were struck 201,088 pieces. As to copper, there were only coined 32,256 pence; but of bronze 47 tons weight were coined by a private firm under Government contract into 5,053,440 pence; whilst 6,630,400 bronze halfpence, and 2,867,200 farthings were struck. The metal for the copper and bronze coinage cost £9185, whilst the coins themselves represent the value of £37,990. The expenses of the mint establishment during the year amounted to £32,513.

Accidents in Coal Mines.—The annual reports lately published by the Government inspectors of mines show an increase of 22 per cent. in the number of lives lost from mining accidents in 1860 as compared with 1859. The quantity of coal raised in 1860 is estimated at 72,000,000 tons; and the proportion of deaths was from explosions from fire-damp, one to each 198,347 tons raised; from falls in mines, one to each 185,567 tons; from accidents in shafts, one to each 395,604 tons; from miscellaneous accidents under ground, one for each 590,164 tons; and from accidents at surface, one for each 1,333,333 tons. The average number of lives lost for each million tons of coals raised was 15·5 in 1859, and 15·4 in 1860, the extraction of coal having rather more than kept pace with the increased sacrifice of life. It should be added that the number of accidents diminished 5 per cent., but those which did occur were of a more fatal character.

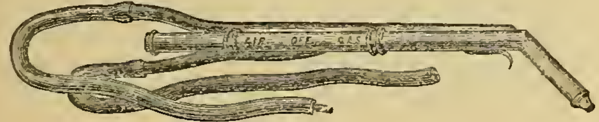
Aluminium.—It is stated in some of the public papers that two vessels have been recently despatched to Greenland to procure cargoes of cryolite, a mineral which is a soda fluoride of aluminium, and possesses the property of melting like ice when ignited. It crystallizes in right rectangular prisms, and has a white or brownish colour. The metal can be obtained in larger quantities from this than from any other mineral, and the demand for aluminium articles is on the increase.

Stockton and Darlington Railway.—The receipts during the half-year ending the 30th of June, including a balance of 1,761*l.* from the preceding account, amounted to 199,417*l.*, and the expenditure, including interest, to 109,787*l.*, leaving a balance of 89,629*l.*, which was equal to a dividend of 9 per cent. per annum on the ordinary shares, after payment of the preferential dividends. It was proposed to raise 287,000*l.* of additional capital on ordinary shares under the Act of 1861, which would make up the ordinary stock to 2,000,000*l.* The South Durham line from Barnard Castle to Tebay had been opened for mineral traffic and would shortly be opened for passengers. The directors adverted with satisfaction to their arrangements with the North-Eastern Railway Company for the interchange of traffic. The capital account showed that 3,091,908*l.* had been expended, leaving a balance of 87,056*l.*

The Indian Museum.—When the old establishment in Leadenhall Street was broken up, the collections of natural history were deposited in the British Museum, and the objects illustrating the arts and industrial pursuits of the Indian people, with the specimens of native products, were removed to Fife House, Whitehall, where the public is admitted to see them on Mondays, Wednesdays, and Fridays, from 10 to 4 o'clock. This museum well deserves a visit, for almost every article of raw produce, and every branch of industrial operations, are here illustrated. In the grounds around the house have been placed certain sculptured marbles from the ruined temple of Amrawuth, which was dedicated to the worship of Buddha. These marbles are remarkable for the delicacy of their finish.

Chimney for Paraffin Oil Lamps.—In the case of lamps for burning the paraffin oil, of which there is now such an immense consumption, it is well known that the wick is a flat band. For such a wick, it is manifest that a round chimney is not well suited, as there is always a risk of the glass being cracked by the heat being greater along two lines than elsewhere. To obviate this inconvenience, Messrs Dinks & Sons have contrived a chimney which is compressed into an elliptical section, so that the flame is at an equal distance from it in every part, and thus the glass is equally expanded by the heat. Another contrivance they have brought out is, the enclosure of the pinion employed in raising the wick in a case, whereby volatilization of the oil through the slot in which the pinion works is prevented.

Gas Blow-Pipe.—Mr Matthews, of Drury Lane, London, has invented a gas blow-pipe, to obviate the inconveniences experienced in using existing ones. The woodcut shows that consists of two vulcanized india rubber tubes, one conveying the supply of gas, the other, with a mouth-piece, conducting a stream of air from the mouth, or from an air-holder. The orifice of the air-conducting tube is in the middle of that supplying the gas. By moving the slides marked "air," and "gas," the supply of either can be modified to any desired extent, and thus the character of the flame can be altered as the operator may require, without taking it away from the work. By this contrivance, a large and powerful flame may be immediately changed to one with a fine point. The utility of such a blow-pipe is obvious.



Book-Post to and from France.—Before the prorogation there was laid before Parliament a convention which has been entered into with France, extending the privilege of the book-post between the two countries to patterns of no intrinsic value, photographs, commercial and legal documents printed or engraved or lithographed, works bearing corrections or manuscript notes; and "all other papers in manuscript," but there must be nothing in the nature of a letter, or which could serve as such, and prepayment is to be essential. The day for carrying the convention into execution was left to the respective Post-offices.

Endless Railway Traction Engines.—As the legislature has at length interfered, to allow of the transit of steam carriages on public roads without being subjected to an exorbitant rate of toll, it has been thought desirable to attempt the formation of a public company for the manufacture and sale of Boyack's Endless Railway Traction Engines. In addition to the home sale, it is hoped that the demand from abroad will increase, as the adaptability of these engines for use on common roads becomes better known.

Hermetical Graphite Cement.—An excellent cement for luting the joints of steam boilers, gas pipes, &c., may be obtained by mixing 6 lbs. of plumbago, 3 lbs. of chalk, 8 lbs. of sulphate of baryta, and 3 lbs. of linseed oil, well boiled. The plumbago, chalk, and baryta should be reduced to fine powder, and well mixed with the oil. This simple cement is greatly superior to red lead cement.

Photography.—It is reported that a German, called Wothby, has discovered some cheap and simple chemical composition for obtaining light pictures without the aid of nitrate of silver or chloride of gold. The nature of the material has not yet been disclosed.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

The following Applications for Letters Patent were inadvertently left out of the June Number of the Practical Mechanic's Journal—*viz., Nos.* 707-779, *inclusive.*

21*st March*, 1861.

707. Marc A. F. Mennons, Rue de l'Echiqnier, Paris—Improvements in gas stop-cocks.—(Communication from Messrs A. Massey, G. Jullien, and E. Jullien, Paris.)
708. James Franks, Little Tower Street—An improved mixture and preparation of teas, to be called "the Royal Osborne mixture."
709. George Baxter, Govan, Lanarkshire—Improved apparatus for propelling vessels.
710. William Andrews, Threadneedle Street—Improvements in insulators for telegraph wires.
711. Joseph Rhodes, Wakefield, Yorkshire—Improvements in means or apparatus for generating steam.
712. Charles Taylor, jr., Nottingham—Enabling the guard or other person to communicate with the engine-driver, or vice versa, in railway carriages or railway trains, or similar conveyances, by means of electricity.
713. Alfred Heaven, Richmond Grove East, Longsight, and Robert Smith, Higher Chatham Street, Chorlton-upon-Medlock, Manchester—Improvements in embroidering machines.
714. Thomas Greenwood, Leeds, Yorkshire, and Arthur Kinder, Great George Street, Westminster—Improvements in machinery for cutting or working in wood.
715. William Clark, Chancery Lane—Improvements in apparatus for cutting and shaping metals.—(Communication from Mr Aaron Bonehill, Paris.)

22*d March*, 1861.

716. William M'I. Cranston, King William Street—Improvements in sewing machines.—(Communication from James Frost, New York, U.S.)
717. Fidele J. Wagon, Issay, near Paris—Improvements in the manufacture of soap.
718. Thomas S. Truss, Grove Terrace, Plaistow, Essex—Improvements in propelling ships and other vessels.
719. Joseph Victor, Wadebridge, and James Polglase, Bodmin, Cornwall—Improvements in safety fuses for mining and other purposes.
720. Thomas Hindle, Blackburn, Lancashire—Improvements in looms for weaving.
721. William Clark, Chancery Lane—An improved method of locking the nuts on railroad rail bolts.—(Communication from Messrs Henry Lawrence, Charles H. White, and Thomas W. White, Melrose, Westchester, New York, U.S.)
722. Richard A. Brooman, Fleet Street—Certain means of colouring enamelled leather, leather, cloth, enamelled metal, and other enamelled surfaces.—(Communication from Adrien J. Basset, Paris.)
723. John Armour, Kilmarnock—Improvements in increasing the generation of steam in boilers.
724. Edward Humphrys, Deptford, Kent—Improvements in steam engines.
725. Thomas Rawtenstall, Lancashire—Certain improvements in apparatus for spinning and doubling cotton and other fibrous materials.
726. James Graham, Warrington Junction, Lancashire—Improvements in preparing and annealing iron wire.
727. Samuel Jackson, Sheffield, Yorkshire—Improvements in the manufacture of spades, shovels, and other articles of a similar nature.
728. Charles E. Swindell, Joseph Russell, and Joseph Price, Withymoor, near Dudley, Worcester—Certain improvements in the manufacture of horse nails.
729. Abraham Haley, Frome, Somerset—Improvements in power looms for weaving check patterns, and in connecting rods for power looms.
730. John Potter, Leeds, Yorkshire—Improvements in the construction of wire and other similar fences.

23*d March*, 1861.

731. Joseph C. Rivett, Farnworth, near Manchester—Certain improvements in machinery for carding cotton and other fibrous materials.
732. William H. Clarke, Vernon Place, Bloomsbury Square—Improvements in commissariat ambulance cooking apparatus and appurtenances.
733. George J. B. Loyer, Brunswick Place, Brixton Hill, Surrey—Irrigating or self-supplying water brushes, brooms, and sponges.—(Communication from Mr J. Lemoine, Rue St. Paul, Paris.)
734. William T. Henley, Saint John Street Road, Clerkenwell—Improvements in electric telegraphs and in apparatus connected therewith.
735. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—An improved skating chair.—(Communication from Frederick Ashley, New York, U.S.)
736. John Billing, Abingdon Street, Westminster—An improved chimney head.
737. John Spencer, Doncaster, Yorkshire—Improvements in the construction of harrows.
738. Thomas Cardwell, London, and David Campbell Derby Buildings, Liverpool, Lancashire—Improvements in machinery for pressing or baling cotton and other substances.
739. Henry Wickens, Tokenhouse Yard, Bank—Improvements in shuttles for weaving.

25*th March*, 1861.

740. William E. Manby, Victoria Wharf, Augustus Street, Regent's Park—The manufacture of paper, linen, or other fabrics prepared with a preparation of blue, to be used for the purpose of washing or other purposes.

741. Paul R. Hodge, Blessington Road, Lee, Kent—An hydraulic press, which I term my "Improved inverted hydraulic press," for pressing of hay, straw, hops, hemp, or flax, cotton, or animal wool, animal or vegetable oils, or any other materials.

742. John T. Holden, Birmingham, Warwickshire—An improvement in or addition to victorines, boas, collars, and other like articles of dress for females.

743. Sir William G. Armstrong, Northumberland — Improved breech-loading cannon.

744. John Grant, Mansfield, Nottingham—Improvements in machinery or apparatus for twining or spinning and doubling cotton or other yarns and threads.

745. John Brown and Robert Gregson, Middleton, Lancashire—Certain improvements in self-acting mules for spinning cotton and other fibrous materials.

746. Sidney A. Beers, Brooklyn, New York, U.S.—Improvements in rails for tramroads, and in laying down the same in streets and highways.

747. William Bailey, Wolverhampton, Staffordshire—Improvements in the manufacture of globes or shades and chimneys for lamps, gas lights, or gas burners.

748. John Morgan and Alfred T. Jay, Upper Thames Street, Edmund Edwards, Beaufort Buildings, Strand, and Joseph Tilston, Lower Gore, Kensington —Improvements in ropes or cables for submarine or other electric telegraphs, and for the rigging of ships, and other purposes.

749. William Brookes, Chancery Lane—Improvements in means or apparatus for measuring gas.—(Communication from William Richards, Barcelona, Spain.)

750. Frederick Versmann, Bury Court, St. Mary Axe—Improvements in the manufacture of colour adapted for dyeing, painting, and other uses.

751. John Spencer, yr., and Michael Spencer, Newcastle-upon-Tyne—Improvements in the manufacture of cast steel tires.

752. Thomas Bentley, Margate, Kent—Improvements in making up or packing charges or small quantities of gunpowder, drugs, or other articles.

753. John Chatterton, Highbury, and Willoughby Smith, Dalston—Improvements in submarine telegraph cables.

754. George F. Morrell, Fleet Street—Improvements in the manufacture of sealing wax.

26*th March*, 1861.

755. Henry Spencer and Edmund Taylor, Rochdale, Lancashire—Improvements in steam engines and boilers.

756. Samuel Lamb, Manchester—Certain improvements in pipes for smoking tobacco.

757. John Smith, yr., Coven, and John B. Higgs, Brewood, Staffordshire—An improvement or improvements in thrashing machines.

758. William F. Brown, Westgate Street, and Walter Jeffery, Eastgate Street, Gloucestershire—A more convenient and effectual method of attaching and securing brooches and such like articles, and for improved fastenings to be used therewith, and for other purposes.

759. Thomas Davidson, Belfast, Antrim, Ireland, and Robert Paterson, Glasgow, Lanarkshire—Improvements in and connected with steam engines.

760. Hannah Emes, St. John's Villas, Adelaide Road, Hampstead—Improvements in dress fastenings.

761. John Savory and William R. Barker, New Bond Street—An improved "douche" for the ear and other parts of the human body.

27*th March*, 1861.

762. William Jeffs, Manchester, and Joseph Pennock, Blackley, near Manchester, Lancashire—Improvements in steering ships or boats, and in apparatus connected therewith.

763. William Spence, Chancery Lane—Improvements in dressing or preparing the surface of millstones.—(Communication from Louis Wells, Broadwell, St. Petersburgh.)

764. Weston Grimshaw, Lytham, Lancashire—Improvements in machinery and apparatus used in drying, pulverizing, and compressing clay and other materials.

765. Edward Briggs and Samuel Fearnley, Rochdale, Lancashire—Improvements in the manufacture of piled fabrics, and in the machinery or apparatus employed in manufacturing piled and other fabrics.

766. William E. Gedge, Wellington Street, Strand—Improvements in lamps—(Communication from Pierre Vanrechen, Waton, near Yypres, Belgium.)

767. Charles D. Abel, Southampton Buildings, Chancery Lane—Improvements in the construction of wardrobes.—(Communication from Emmanuel Guyennet, Lyons, France.)

768. John M. Dunlop, Manchester—Improvements in machinery for cleansing cotton.

769. Jacob G. Willans, Clarence Place, Belfast—Improvements in the preparation of hydrated oxide of iron, and the application of such prepared oxide for the absorption or separation of sulphur from certain gases.

28*th March*, 1861.

770. Francois Chevillard, Herts, France—The suppression of cylinders with pistons in machines worked by concentrated power.

771. Bartholomew Brittain, Cowley Road, Brixton, Surrey—Improvements in obtaining motive power.

772. James B , Leith, Edinburgh—Improvements in steam boilers.

773. Percival M. Parsons, Arthur Street West, London Bridge—Certain improvements in fire-arms and in the method of rifling the barrels of the same.

774. John C. Keen, Birmingham, Warwickshire—An improvement or improvements in the manufacture of braces.

775. Louis J. Vandecasteele, Lille, France—Improvements in brewing.

776. James Sauderson, Clerkenwell—Improvements in travelling bags or cases, and in fittings for the same, a part of which fittings is applicable to holding cigars and other like articles.

777. Richard A. Brooman, Fleet Street—Improvements in the manufacture of shear steel.—(Communication from Wilhelm Spiefeld, Unna, Westphalia.)

778. William Sorrell, Haggerstone—Improvements in apparatuses for mashing malt.

779. William Stratford, Mile End, Old Town—Improvements in the construction of furnaces for heating steam boilers, bakers' ovens, and brewers' coppers, which improvements are applicable also to furnaces made use of for various other purposes.

The following Applications for Letters Patent follow those which appeared in the August Number of the PRACTICAL MECHANIC'S JOURNAL.

19*th July*, 1861.

1815. Robert Walker, Eccleston, near Prescot, Lancashire—An improved apparatus for stopping and packing bottles.

1816. Daniel Gallafent, Stepney Causeway—Certain improvements in refrigerators for cooling liquids.

1817. Robert Mushet, Coleford, Gloucestershire—Improvements in the manufacture of cast steel.

1818. Philander Shaw, Boston, Suffolk, Massachusetts, U.S.—Improvements in hot air engines.

1819. Robert Laing and George H. Cossius, Ince, near Wigan, Lancashire—An improved mode of obtaining nitrous acid gas for making sulphuric acid.

1820. Richard C. Newbery, President Street West, Goswell Road—Improvements in the manufacture of enamelled cards.

1821. William Savory and Paul H. Savory, Gloucestershire—An improved winding apparatus particularly adapted for steam ploughing, winding at pits, quarries, and other such like purposes.

1822. Michael Henry, Fleet Street—Improvements in the production of paper pulp and in bleaching paper pulp and certain fabrics, also an apparatus for cutting wood applicable for carrying out part of the invention.—(Communication from Marie A. P. V. Caurique, Boulevard Saint Martin, Paris.)

1823. Richard A. Brooman, Fleet Street—An improvement in propelling ships and other vessels.—(Communication from Eugene Coulon, Rouen, France.)

1824. Richard A. Brooman, Fleet Street—Improvements in breech-loading ordnance, applicable also to small arms.—(Communication from Lewis Wells, Broadwell, Saint Petersburg, Russia.)

1825. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the manufacture of ships' armour plates and other heavy forgings, and in the machinery or apparatus employed therein.—(Communication from Messieurs Petin, Gaudet, and Company, Rive de Gier, France.)

1826. William E. Newton, Chancery Lane—Improved apparatus for copying letters or writings and draughts.—(Communication from Francis Tryon, George Heydecker, and William V. Andeu, New York, U.S.)

20*th July*, 1861.

1827. Edward T. Hughes, Chancery Lane—Improvements in machinery or apparatus for manufacturing woven seamless gloves.—(Communication from Messieurs Berjon and Alphonse Berthod, Lyons, France.)

1828. Moses Gilbert, Manchester, Lancashire—Certain improvements in boots and shoes or other coverings for the feet.

1829. William Price, Lambeth, Surrey—Improvements in tools for cutting shives and other conical blocks.

1830. Robert Thatcher, Oldham, Lancashire—Improvements in lubricators for lubricating the various parts of machinery.

1831. Thomas Roberts and John Dale, Manchester, Lancashire—Improvements in the manufacture of gunpowder.

1832. John Platt and John Buckley, Oldham, Lancashire—Improvements in machinery for spinning and doubling cotton and other fibrous materials.

1833. John Cole and Joseph Cole, Coventry, Warwickshire—An improvement in the construction of watches.

1834. Michael Henry, Fleet Street—Improvements in lighting.—(Communication from Charles F. Le Page and Cyprien Poisson, Boulevart Saint Martin, Paris.)

22*d July*, 1861.

1835. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in safety locks.—(Communication from Francois J. Toulze, Paris.)

1836. Constantine N. Kottula, Holborn—Certain new compositions to be used in the manufacture of soap.

1837. Archibald Watson, Johnstone, Renfrewshire—Improvements in brake apparatus for common road vehicles.

1838. John B. Wood, Broughton, near Manchester, Lancashire—Improvements in the manufacture of shuttle pickers.

1839. William Hood, Reading, Berks—Improvements in beams and girders, and in applying the same in buildings.

1840. William E. Newton, Chancery Lane—Improvements in engines for obtaining motive power.—(Communication from Franeisque Million, Paris.)

1841. Joseph Beattie, Lawn Place, South Lambeth, Surrey—Improvements in arrangements in buildings and ships with a view to the extinguishment of accidental fire therein, and also the ventilation thereof.

23*d July*, 1861.

1842. Charles Batty, Marylebone Road—The preventing of the extension of fire in buildings.

1843. George F. Griffin, New Adelphi Chambers—Improvements in the permanent way of railways.

1844. Thomas Gray, Hill's Cottages, Union Street, Wandsworth, Surrey—An improved method of preparing flax from old materials for spinning and other purposes.

1845. Nicolas E. Dumesnil, Rue aux Loups, Sotteville-les-Rouen, France—Improvements in lubricating materials.

1846. Robert Thompson, Charlton, Kent—A machine for cutting wood.

1847. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in forges.—(Communication from Martin Chretiennot, commonly called Chretiennot-Radet and Pierre Leon Rodet, Paris.)

1848. Ferdinand Hirschfeld, Cannon Street West—Improvements in ornamenting or decorating articles of iron.—(Communication from Jean B. Haffner and Jean P. Haffner, Paris.)

1849. William Clark, Chancery Lane—Improvements in apparatus for the condensation of steam in marine engines, and in the particular application of parts thereof to the ship.—(Communication from William Lighthall and Albert N. Chrystie, Boulevart St. Martin, Paris.)

24th July, 1861.

1850. Ferdinand Hirschfeld, Cannon Street West—Improvements in locks and keys.—(Communication from Jean B. Haffner and Jean P. Haffner, Paris.)

1851. Thomas Hughes, Birmingham, Warwickshire—An improved steam generator.

1852. Frederick Mills, Heywood, near Manchester, Lancashire—Certain improvements in machinery for carding cotton and other fibrous materials.

1853. John Sidebottom, Harewood, near Mottram, Cheshire—Improvements in fire-arms and ordnance.

1854. Joseph Badard, Rue St. Cecile, Marseilles, France—Turning and planing metals, the tool advancing sideways, and cutting in an oblique position.

1855 Henry Neville, Portsmouth, Southampton—Improved apparatus for taking photographs.

1856. William E. Gedge, Wellington Street, Strand—Improvements in the preparation and clarification of the saccharine matters obtained from beetroot, sugar cane, Indian millet, and other sacchariferous vegetables or plants.—(Communication from Louis C. Bernard, Wasserling, Haut Rhin, France.)

1857. William M'I. Cranston, King William Street, London Bridge—Improvements in grass-mowing machines.—(Communication from William A. Wood and John M. Rosebrooks, Hoosick Falls. New York, U.S.)

1858. Alfred Wood, Lewes, Sussex—Improvements in apparatus employed for fermenting purposes in brewing beer, as also for storing beer and for general purposes of fermentation.

1859. Richard Threlfall, Bolton, Lancashire—Improvements in machinery or apparatus for spinning cotton or other fibrous material.

1860. Adolf J. D. Seitz, Newcastle-upon-Tyne—Improvements in the drying of bricks and other articles manufactured of fire-clay or common clay, and in the construction of drying rooms for such purpose.

1861. John Platt and William Richardson, Oldham, Lancashire—Improvement in machinery or apparatus commonly called "gins," for cleaning cotton from seeds.

1862. Henry Cook, Manchester, Lancashire—Improved apparatus for punching or marking the pattern cards used in weaving figured fabrics.

1863. William Longmaid, Inver Galway, Ireland—Improvements in the manufacture of iron.

25th July, 1861.

1864. Frederick D. Blyth, Fenchurch Street—Improvements in tools.—(Communication from Washington Mears, Beekman Street, New York, U.S.)

1865. Benjamin Brown and Richard Hacking Bury, Lancashire—Certain improvements in machinery or apparatus employed in spinning cotton, wool, silk, and other fibrous substances.

1866. Marc Klotz, Boulevart St. Martin, Paris—A new application of certain products to ornamenting tissues, papers, and other surfaces.

1867. Daniel Spink, Eastbourne, Sussex—Improvements in steam engines.

1868. Robert Kelly, Wilden, near Stourport, and John Shakespeare, Dudley, Worcestershire—New or improved machinery to be used in the manufacture of tin plates and terne plates, and iron plates coated with lead.

1869. Edward Haeffely, Kearsley, Lancashire—Improvements in extracting copper from its ores.

1870. James Simmons, Wellington Lane, Battersea, Surrey—Improvements in the construction of buildings to enable them to withstand the destructive action of fire.

1871. Charles Robertson, Edinburgh, Mid-Lothian—Improvements in sights for fire-arms.

26th July, 1861.

1872. Richard R. Swann, the Grove, Blackheath, Kent—A fire preventive ceiling and apparatus for the extinction of fire in warehouses, stores, depots, and buildings.

1873. John F. Bourne, Georgetown, Demerara—Certain improvements in the construction, armament, and equipment of batteries, floating or otherwise for war purposes.

1874. Frederick Johnson and Bartholomew Hockin, North Street, Smith's Square, Westminster—Improvements in securing or fastening nuts for railway fish plates and for other purposes.

1875. Félicité N. Thurel, South Street, Finsbury—A method of fastening shoes, stays, gloves, and other wearing apparel.

1876. Edward Sang, George Street, Edinburgh—An apparatus for indicating the direction of objects and measuring angles.

1877. William Wigfall, Sheffield, Yorkshire—Improvements in the manufacture of brushes and brooms.

27th July, 1861.

1878. William E. Gedge, Wellington Street, Strand—An improved weighing machine.—(Communication from Charles Thuau, Passage des Petites Ecuries, Paris.)

1879. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in sewing machines.—(Communication from the Grover and Baker Sewing Machine Company, Broadway, New York, U.S.)

1880. Robert E. Garrood, High Street, Chelmsford, Essex—Improvements in mitre boxes and shooting boards.

1881. James B. Herbert, Newman Street—Improvements in fire guards.

1882. William H. Harfield, Royal Exchange Buildings—Improvements in constructing and propelling ships and vessels.

1883. Ewing P. Colquhoun and John R. Thomson, Laurence Pountney Hill—Improvements in fire-bars for furnace grates.

1884. Charles E. Amos, the Grove, Southwark, and John Francis, Penrhynn Slate Quarries, near Bangor, North Wales—Improved machinery for dressing slates.

1885. James Robertson, Park Street, Mile End—Improved apparatus for the treatment of the human body or any part thereof when afflicted with pain.

1886. Sir John Hare, Hardelot Castle, Pas de Calais, France—Improvements in the manufacture of sugar.

29th July, 1861.

1887. George Sturrock, Woolwich, Kent—Improvements in the construction of breech-loading fire-arms.

1888. Frederick Tolhausen, Boulevart Bonne Nouvelle, Paris—Improvements in comforters, neck-ties, cravats, and the like articles of garment for the neck and chest.—(Communication from Messrs Samuel Weil and Raphael Weil, Brothers, Boulevart Bonne Nouvelle, Paris.)

1889. William Busby and Daniel Busby, Liverpool, Lancashire—Improvements in street or road rails for omnibuses and other vehicles.

1890. Reuben Riley, Hull, Yorkshire—Improvements in fusee signals, and in means or apparatus for applying or placing them and fog signals on the rails of railways from the van of a train in motion.

1891. William Melrose, Kingsbridge Place, Millwall—Improvements in the construction of railway wheels.

1892. Charles C. J. Guffroy, Lille, France—Improvements in preparing medicinal substances and compounds from the livers of cod and other salt water fish.

1893. Wentworth L. Scott, Bayswater—Improvements in preparing red, purple, and certain other dyes.

1894. Edmond H. Joynson, St. Mary's Cray, Kent—Improved machinery or apparatus for disintegrating, crushing, or drawing out vegetable fibres.

30th July, 1861.

1895. Peter Hall, Birkenhead, Cheshire—A simultaneous manifold drilling machine.

1896. Thomas Saunderson, Princes Street, Dunston Road, Kingsland, N.E.—A pasteboard, millboard, and cardboard medal for advertising purposes, in lieu of handbills.

1897. Thomas Bradford, Fleet Street — Improvements in washing, churning, wringing, and mangling machines.

1898. William H. Ash, London, Canada West—Improvements in reaping and mowing machines.—(Communication from Nicholas Coones, London, Canada West.)

1899. Thomas S. Cressey, Burton-on-Trent—Improvements in machinery used in the manufacture of casks.

1900. Alexander Parkes, Birmingham, Warwickshire — Improvements in the manufacture of sheathing metal for ships and vessels.

1901. Matthew Allen, Worship Street, Finsbury—Improvements in the construction of buildings, and in materials and machinery to be employed therein and therefor.

1902. John M. Hart, Cheapside—Improvements in the arrangement or construction of parts of locks or fastenings.

31st July, 1861.

1903. Harrold Potter, Manchester—Improvements in treating or preparing textile materials and fabrics.

1904. Harris J. Holland, Bond Street, and Walter Payton, Johnson Place, Harrow Road—Improvements in breech-loading fire arms.

1905. Alfred Wood, Lewes, Sussex—Improvements in refrigerating storehouses and in other structures in which a low temperature is continually or periodically required.

1906. Joseph F. Flanders, Wardrobe Place—Improvements in machinery for splitting, dividing, or shaving leather or skins or sheets of manufactured fabrics.

1907. John Rylands, Thomas G. Rylands and Peter Rylands, Warrington—Improvements in joining wire for telegraphic conductors and other purposes.

1st August, 1861.

1908. Herbert J. Walduck, Manchester—Improvements in machinery and apparatus for retarding and stopping railway engines and carriages.

1909. Benjamin Browne, King William Street—An improved self acting tap or apparatus specially adapted for lighting cigars.—(Communication from Theodore B. Hubbell, Bridgeport, Connecticut, U.S.)

1910. Horatio Mearing, Great Randolph Street, Camden Town—Procuring a light in the form of an improved lucifer match and prepared paper for igniting the same.

1911. Robert Harrison, Port Penrhyn, Llandegai, Carnarvon—Improvements in apparatus for cutting slates and slabs.

1912. Henry Shaw, Lower Ormond Quay, Dublin—Improvements in wet gas meters.

1913. Alexander Powell, Liverpool, Lancashire—Improvements in boots, shoes, and other coverings for the feet.—(Communication from Mr Charles W. Bryant, Boston, Massachusetts, U.S.)

1914. Edward J. Muygridge, St. John's Villas, Adelaide Road, St. John's Wood—Improvements in machinery or apparatus for washing clothes and other textile articles.

1915. John Cook, East India Road—Improvements in smoke-consuming furnaces.

1916. Matthew Pratt, Staffordshire—An improved mode of manufacturing candle moulds.

1917. George Edwards, Park Road Villas, Battersea. Surrey—A new system of traction for railways, tramways, and other roads.

2nd August, 1861.

1918. James Wright, Bridge Street, Blackfriars—Improvements in machinery to be used in carding cotton and other textile substances.—(Communication from Amand Wibaux, Rue Saint Martin, Paris.)

1919. Robert Benton, Great College Street, Westminster—Improved motive power machinery or apparatus.

1920. Frederick W. Turner, Swansea, Glamorgan—Improvements in apparatus for obtaining and applying the motive power of steam.

1921. Joseph E. Drouot, South Street, Finsbury—Some improvements in kneading machines.

1922. William E. Newton, Chancery Lane—Improved machinery for cleaning rice, coffee, and other grains or seeds.—(Communication from Amasa Howe, New York, U.S.)

3rd August, 1861.

1923. Edwin Tomlinson and George W. C. Wilson, Liverpool, Lancashire—Improvements for facilitating the extinguishing of fires in warehouses and other buildings.

1924. George Bish, High Street, Stratford, and James Dredge, Adam Street, Adelphi—Improvements in forming bends and other forms or parts of non-metallic pipes and in machinery or apparatus employed for such purposes, part of which improvements are applicable also to the formation of bends or curves in some kinds of metallic pipes.

1925. Moses Merryweather and Richard M. Merryweather, Long Acre—Improvements in pumps applicable to steam and other fire engines.

1926. Jane Cross, Manchester, Lancashire—Improvements in fastenings for wearing apparel and in the application thereof.

1927. George F. Jones and James Jones, Yorkshire—Improvements in protecting and arranging water pipes, and in mechanical contrivances for withdrawing the water from the same and preventing their being injured by frost.

1928. Charles Schinz, Offenburg, Baden—Improvements in glass furnaces.

1929. Gustave L. M. V. de P. D'Amécourt, Paris—An aerostatical apparatus called "Aeronef or helicoptere."

1930. Pierre Habert, Bar-le-duc, France—An improved circular loom for weaving cloths of all kinds, either plain or ornamented.

1931. John Henderson and James Broadley, Saltaire, near Bradford, Yorkshire—Improvements in means or apparatus employed in weaving.

1932. Patrick O'Hanlon, Nile Street, Kingston-upon-Hull—Improvements in marine and other steam boilers with reference to economy of fuel.

1933. Josiah Vavasseur, Gravel Lane, Southwark, Surrey—A new transportable machine for rifling cannon.

1934. Alexander Prince, Trafalgar Square, Charing Cross—Improvements in palate and tooth plates for dental purposes.—(Communication from John Mittlehaus, Berlin, Prussia.)

1935. William E. Newton, Chancery Lane—An improved process for producing colouring matters or pigments from manganese.—(Communication from Paul Morin and Co., Paris.)

1936. Joseph Lewis, Rathmines, Dublin—Improvements in producing and treating printing surfaces, in producing and preparing transferring surfaces, in transferring, in producing impressions on an altered scale, in preparing or treating surfaces of lithographic stones, and in obtaining devices or designs; also in agents and apparatus used in some of such improvements, parts of the invention being also applicable to photography, and to ornamenting pottery, porcelain, and glass.

5th August, 1861.

1937. Francis Richmond and Henry Chandler, Salford, Lancashire, and William B. Ritchie, Belfast, Antrim, Ireland—An improved sack holder.

1938. Charles Burn, Delahay Street, Westminster—Improvements in the mode of fastening iron armour plates to ships' sides.

1939. Hermann C. Meyer, Hoxton—Improvements in slide valves to regulate or stop the flow of water, steam, or other fluid.

1940. Samuel S. Fitch, Upper Seymour Street, Portman Square—An improved chest expander.

1941. Edward D. Johnson. Wilmington Square—An improvement in the construction of centre seconds watches.

1942. John Potter, Leeds, Yorkshire—Certain improvements in the construction of straining pillars or posts for wire or other strained fencing, and in the apparatus to be adapted thereto for straining or tightening the wires or strands.

1943. Richard A. Brooman, Fleet Street—Improvements in locks and other fastenings and in keys.—(Communication from Auguste T. Baudrit, Paris.)

1944. Frédéric Seiler, Paris—An improved mode of overleaping differential levels, applicable to canals and to other purposes.

1945. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the grates of reverberatory and other metallurgic furnaces.—(Communication from Adolphe Grisard-Vanzuyleu, Chaudfontaine lez-Liege, Belgium.)

6th August, 1861.

1946. Jean A. Petit, Red Lion Square—Improvements in the manufacture of watches and clocks.

1947. Marc A. F. Mennons, Rue de l'Echiquier, Paris—An improved odontalgic elixir.—(Communication from Jean P. Tajan, Paris.)

1948. William Galloway and John Galloway, Manchester, and John W. Wilson, Barnsley. Yorkshire—Improvements in steam boilers and in apparatus connected therewith.

1949. George Potts, Edinburgh, Midlothian—Improved elastic steel mattresses.

1950. Rudolph Wappenstein, Manchester, Lancashire—An improved cop tube and cover for rollers used in spinning, and in apparatus for putting the tubes on the spindles.

1951. John Turner and Robert B. Dunnett, Liverpool, Lancashire—Improvements in stamping, endorsing, and embossing machines.

1952. Frederick Tolhausen, Boulevart Bonne-Nouvelle, Paris—Mechanical contrivances increasing the effect of motive power.—(Communication from Francois Berger, St. Etienne, France.)

1953. Joseph MacMorran, Leicester Square—Improvements in the construction of machines for mincing meat and other substances.

1954. Edward A. Cowper, Great George Street, Westminster—Improvements in protecting ships of war and land batteries from the effects of projectiles.

1955. Alcidalis A. R. Damoiseau Paris—Improvements in apparatus for drawing blood or other fluids from the human or animal body.

1956. William Clark, Chancery Lane—Improvements in bleaching and clarifying saccharine matters and in apparatus for the same.—(Communication from Messieurs Edouard T. de Gemini and Co., Edmond O. de Gemini, Boulevart St. Martin, Paris.)

1957. Alfred V. Newton, Chancery Lane—Improvements in the construction of reversible seats.—(Communication from Thomas Rainey, New York, U.S.)

1958. Peter Spence, Newton Heath, near Manchester, and James Mellor, Manchester, Lancashire—Improvements in separating copper from its ores.

1959. Francis Silveston, Coventry, Warwickshire—Certain improvements in watches.

7th August, 1861.

1960. William H. Richards, Massachusetts, U.S.—A new and useful or improved combined knife, fork, and spoon for camp or other purposes.

1961. David Miles, Newport, Monmouthshire—Improvements in the construction of window sashes.

1962. Nicolas A. Lesueur, Boulevart des Amondiers, Paris—A new system of covering for houses and other buildings and coverings.

1963. Edward T. Hughes, Chancery Lane—An improved wheel-barrow waggon.—(Communication from Jean M. Rey, jun., Tournon, Ardeche, France.)

1964. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in certain descriptions of breech-loading fire-arms.—(Communication from Alem Rousseau, Paris.)

1965. William R. Rogers, Gray's Inn Road—Improved machinery to be employed in the application of dowels to woodwork.

1966. Thomas G. Webb, Manchester, Lancashire—Improvements in the manufacture of articles of glass.

1967. Louis W. Viollier, Lyons—Improvements in machinery for doubling and twisting yarns and threads, and for manufacturing wire rope.—(Communication from Mr Antoine Ratigner, Lyons, France.)

8th August, 1861.

1968. John Eastwood and Thomas C. Eastwood, Manchester Road, Bradford, Yorkshire—A new kind of yarn called the "Gorilla yarn," and the cloth woven therefrom called "Gorilla cloth."

1969. Nicholas D. P. Maillard, Dublin, Ireland—Improvements in self-acting and inexhaustible hydraulic and atmospheric motive power engines.

1970. John Gedge, Wellington Street, Strand—An improved apparatus for beating or threshing grain.—(Communication from Monsieur Saint Marc, jr., Puyle Plan, Landes, France.)

1971. John Coldwell and William Coldwell, Sheffield, Yorkshire—Improvements in the manufacture of sheep shears.

1972. Richard Jukes, Sheffield, Yorkshire—Improvements in puddling furnaces.

1973. William S. Hogg, Rotherhithe, Surrey—Improvements in the construction of doors, gates, and shutters, principally applicable for fire proof buildings.

1974. Renil de Clercq and Emile Chazelles, Brussels, Belgium—A new system of machines to raise water or any other liquids, called fly-wheel pumps or hydraulic fly-wheel.

1975. George H. Bovill, Durnsford Lodge, Wimbledon, Surrey—Improvements in the construction of vessels and in apparatus for vessels of war; also in the manufacture of wrought iron boilers, girders, and ships, and in the manufacture of iron plates for the same.

1976. Alfred V. Newton, Chancery Lane—Improvements in the construction of sewing machines.—(Communication from William C. Hicks, Boston, U.S.)

1977. Alfred V. Newton, Chancery Lane—An improvement in single thread sewing machines.—(Communication from William C. Hicks, Boston, U.S.)

1978. Louis Le Paige, Merxem, near Antwerp, Belgium—Improvements in treating fatty and oily matters obtained from wash waters to deprive them of their smell.

1979. Henry Kinsey, Nottingham—Improvements in steam engines and boilers.

9th August, 1861.

1980. George Haycraft, Lombard Street—Improvements in powder flasks.

1981. Albert J. Mott, Liverpool, Lancashire—An improvement in or application to casks and other vessels by which beer and other liquids can be withdrawn or forced from the said casks without allowing the air to come in direct contact with the said liquids.

1982. Charles P. Moody, Corton Denham, Somersetshire—Improvements in the construction of gates.

1983. James Hemingway, Robert Town, Yorkshire—Improvements in machinery or apparatus for working coal, ironstone, or other minerals.

1984. Léonard Vassiviere, Lyons, Rhone, France—A smoke-consuming apparatus.

1985. Joseph Griffin and Charles Griffin, Walsall, Staffordshire—New or improved machinery for the manufacture or cutting of corks and bungs.

1986. Henry Chatwin, Birmingham, Warwickshire—Certain improvements in the manufacture of card, needle, pin, and other cases, and in the application to such articles of a new branch of ornamental art not hitherto applied to such goods.

RETROSPECTIVE REVIEW OF THE ACTUAL STATE OF CIVIL AND MECHANICAL ENGINEERING.

VII.

The question raised by Sir Wm. Armstrong with respect to the advantages or the disadvantages of the Patent Laws, continues to occupy the attention of both the industrial public and of politicians; and indeed it would be impossible to find a subject for consideration of a more important character, either practically or theoretically. The question really involved in the discussion is, How society is the most likely to benefit by the ingenuity of its various members, and how the latter are the most likely to be excited to exert themselves for the advancement of our race in its pursuit after happiness, so far at least as material objects can advance that end? In fact, society has a right to the exertions of its individual members; but at the same time it has the contingent duty of rewarding those who serve its interests, and the great difficulty to be solved in this discussion is, How can society reconcile the two conditions which so singularly bear upon some of the deepest problems of our nature? Unfortunately Sir Wm. Armstrong and his friends have only looked at the question from the point of view connected with the rights of society. Their opponents are apt to dwell exclusively upon the rights of inventors; and thus it has happened that public attention has been diverted from the real bearings of the subject. The patent laws of England may be, and in many instances they no doubt are, serious impediments to the development of inventions; but, like the patent laws of all other civilized nations, they are based upon the principle of endeavouring to secure the rights of the respective parties availing themselves of the advantages those laws offer. Sir Wm. Armstrong's criticism, therefore, even if the facts on which they are based do not bear a construction very different from the one he has drawn, only proves that our present patent laws require to be changed in their details, not that the principle on which they are founded is wrong. Invention must be encouraged; inventors must be rewarded for the publication of the results of their study and labour. Whether these objects be effected by the purchase of inventions by the State, or by the creation of a temporary monopoly in their application, may be worthy of consideration; but, in one way or the other, society must be prepared to reward those who labour for its advancement, or progress will no longer be possible. If inventors derived no legally secured benefit from their efforts, they would either cease to labour, or keep their processes to themselves; and it really does seem to us self-evident that the species of temporary monopoly created by patent laws furnishes the easiest and justest method of paying the real value of the service rendered. Sir Wm. Armstrong has done good by calling attention to some of the practical inconveniences of the laws as they now stand; and it is to be hoped that the result of the discussion thus raised may lead to their removal. The total abrogation of the system of patents, however, would be, we are convinced, a fatal blow to the industry of the world.

The name of Sir Wm. Armstrong of course recalls the very important subject of the recent modifications of warlike implements, and to us it would appear that the most valuable result of the various experiments lately made has been to demonstrate the necessity for the discovery of some method of producing a material of the homogeneous character of cast-iron, combined with the strength of steel. Neither cast or wrought-iron can support the concussions produced by the heavy charges of gunpowder now used; and yet manufacturers talk of increasing the weight of the projectiles from 100 lbs to 600 lbs!—of course using proportionally heavy charges. At present the progress of the arts of attack seems to be limited by this mechanical difficulty, and the system of construction adopted in the best targets tried at Shoeburyness would also appear to have established the superiority of the means of defence. This can, however, only be a temporary lull in the progress of the science of war, and the efforts of such men as Binks, Bessemer, Frémy, and Carron, will shortly no doubt remove the difficulties and uncertainties which still attend the manufacture of steel at once from the iron ore, and on a large scale. When this object shall have been effected, the race between guns and armour sheathing will be resumed, and another "remodelling of the navy" will become necessary. At present we regret to be obliged to add that the reports we have received from parties competent to form correct opinions on the subject, who were present at the recent trials at Shoeburyness, have led us to believe that the Armstrong gun is a most decided failure. The fire cannot be counted upon with any certainty; the shot are said to strip, and to do great mischief immediately in front of the guns; it is necessary to sponge the guns after every discharge. The gunners handle them with fear and trembling, and indeed it has been confidently asserted that if our Government had not spent such enormous sums of money on Sir Wm. Armstrong's non-patented inventions, the latter would have been long ere now abandoned. It is very sad to hear these rumours; sadder still to know that our officials are usually ignorant, or careless enough to justify the belief in their correctness.

A great deal of attention has lately been called to the results of the competition for the rebuilding of Blackfriars Bridge, on account of the unseemly haste with which the first decision was arrived at, and of the subsequent resilition of the decision. For our own parts, and judging only from the very ill-advised puffs of Mr Page's design inserted in the *Times*, we could not but regret the adoption of such a project, which involved the simultaneous use of cast and of wrought-iron, both under compression, in the girders of the intended bridge. We believe that theoretically and practically such a combination is highly objectionable; and we also most sincerely believe that wrought-iron in any form (as it is now made) ought not to be admitted, as the principal material for a bridge intended to serve as the leading thoroughfare for the portions of London, situated respectively on the north and south banks of the Thames. The oldest cast-iron bridge in existence cannot boast a duration of a century; wrought-iron iron bridges have only been introduced within the last twenty years; and the traffic of such a city as London ought certainly not to be risked upon any experiment. Granite is the only material which is known to be able to resist for ages the combined action of moisture, and of the peculiar atmosphere of London; and it alone ought to be employed for the piers and arches of the proposed new Blackfriars Bridge. Judging also from the puffs, it would seem that the elevation of Mr Page's design would be nearly as much in opposition to the laws of taste as are the Westminster and the Chelsea Suspension Bridges. It is much to be regretted that our civil engineers should neglect this branch of their profession to the extent they actually do. There is hardly a great engineering work erected of late years which is not utterly devoid of anything like artistic feeling, or of charm of outline. Men like Mylne, Rennie, Telford, Mansard, Perronnet, &c., who called themselves Architects as well as Engineers, did not neglect the study of form, and their works, being "things of beauty, are indeed joys for ever." Modern engineers rival one another in the unmitigated ugliness of their buildings. Surely this need not be the case.

The recent proceedings of the Gas Companies which light the city of London, in raising the price of gas, and the contemplated arrangement between the Dock Companies of London for the purpose of putting a stop to the existing competition between those corporations, ought to convince the public (if such further proof were needed) that Robert Stephenson was correct in the opinion he announced of the inevitable result of all competitions of the kind mentioned. Mr Stephenson said that "when competition could only be carried on by companies possessing large capitals, it could not long prevail if combination were possible;" and, it may be added, the combination once effected, the public will always be forced to repay the temporary sacrifices made by the parties who had sought its favour. Nevertheless, it must be a matter of regret to those who wish well to the cause of associated enterprise to witness the very injudicious manner in which the London Gas and Water Companies are now abusing the species of monopolies created for them by recent acts of the Legislature. Gas light has, especially of late years, become a necessity of town life, and the true interests of the producers of that article would, we are convinced, be more advanced by the extension of its consumption than by extorting the maximum profit from the sale of small quantities. Yet not only have the London Gas Companies recently diminished the illuminating power of the article they supply, but they have also increased the price wherever they could do so. The Water Companies have not been quite so unreasonable as their colleagues, it is true; but they have displayed so little desire to satisfy, or to accommodate their customers, that a very strong feeling of hostility is being excited in the public mind against them. Fortunately for the commercial public, the competition of the river side wharves will for a long time counteract the effects of any possible combination of the Dock Companies; but the wharf proprietors will for some time to come have a serious obstacle to contend with, arising from the prejudice against the security of their stores, occasioned by the late dreadful fires on the river side.

The Railway Companies have been either singularly careless, or singularly unfortunate, within the last few weeks; and they have met with so many accidents to their excursion trains as to have created a strong prejudice against that particular branch of their traffic. The judicial inquiries into the causes of the Clayton, and of the Kentish town butcheries, have not yet been completed, and it would not therefore be desirable to make any remarks upon them. Yet we cannot refrain from observing, that the whole system of railway management which prevails in England is so radically defective that the surprise ought rather to be that we hear of so few accidents, than that the results of those which do happen should be so fatal. The men who become directors of railways, as a general rule, have no other than a pecuniary qualification until they enter upon the discharge of functions involving risks of life and limb to thousands of their fellow-creatures; and any one who has had the misfortune to have transacted business with a Railway Board must be convinced of the utter incapacity of such bodies to direct successfully the details of an extensive and complicated series of operations. What is really required for the safety of the public, and the protection of the interests of the shareholders of railways, is that the management of the practical details of the traffic should be confided to one single person, nominated by, and responsible to, the directors; but who should also be responsible in purse and in person for all the accidents which might occur on his line. This system prevails to a certain extent in France, and on the occasion of the accident on the Paris and Rouen line at Bonnieres, on 21st March, 1846, the managing director of the railway, as well as every subordinate official connected with the accident, in any manner whatever, was fined and imprisoned—even after the railway company had settled all the claims for compensation. In fact the French law treats the offence of endangering the lives of citizens as a direct offence against the State; and the agents of a Railway Company upon whose line an accident may occur, are exposed to be prosecuted criminally for such an offence, as well as to a civil action for damages. It is in consequence of the absence of a direct responsibility, on the part of the various agents employed, that we witness the want of punctuality, and the carelessness observable on the majority of our railways; and it is to the latter defects that the majority of the accidents are to be attributed. When passengers are killed by the dozen, or by the score, we really ought to know "whom to hang."

One of the Legislative enactments of the last Session, namely, the one for regulating the tolls to be levied on locomotive engines running on common roads, is likely to turn attention again to that subject. About a quarter of a century ago, Messrs Gurney, Church, Hancock, &c., made earnest efforts to effect the application of steam to ordinary locomotion; but the wonderful success of the railway system, and the narrow-minded opposition of the Turnpike Trusts, combined to throw the humbler application of steam into the background. The disastrous commercial results of branch railways, and the great improvements introduced in the construction of locomotives, are sufficient to account for the return to the system so long discarded; and the Act to which reference has been made has removed the majority of the obstacles the Road Trustees had so unwisely interposed. Of course the traction upon rails must always be more economical than the traction upon the soft spongy surfaces of common roads; but the success of some of the more recently exposed traction engines justifies the belief that "the iron horse" will at last take his place amongst the ordinary powers of locomotion for the everyday wants of society.

The intervention of the State in the relations between capital and labour appears to be extending in England, perhaps in consequence of the natural tendency of highly civilized communities to increase the powers and the duties of the central administration. In the course of the last Session, the provisions of the Factory Acts have been applied to the lace trade, avowedly with the intention of checking the abuse of night work in those factories. Much is to be said on the subject of the policy of these legal interferences with the operations of labour; and for our own parts we confess that it is with regret that we observe the eagerness with which our manufacturing population invoke the protection of the Government, instead of trusting to their own energy in settling the terms of their engagements with their employers. Still the struggle between the owners of large mills, and their work people, is so unequal, and the temptation to work overtime is so great, both to masters and men, that it really seems necessary to define, by some extraneous power, the limits within which the respective parties should be allowed to exercise their rights. The misfortune is that when the State thus begins to interfere for the protection of the labouring class, it is almost impossible to confine its action within the real functions of the central Government; namely, the defence of those who cannot defend themselves. Factory inspectors, indeed, are too much inclined to interfere between masters and men; and the bitter complaints made by the Manchester millowners prove that the system of State control is at least open to serious objection in many cases.

There is another Act of this Session which may have an important bearing on agricultural operations, and thus, indirectly, upon the classes of manufacture this journal is more immediately connected with, namely, the machine-makers, and the converters of agricultural produce; for in this world interests are strangely mingled. The Act in question is the one for facilitating drainage works, by creating facilities for the discharge of the waters carried to the outfall; and they who have watched the progress of the various drainage companies must know the importance of this apparently simple change in the law. Previously, it was in many cases impossible effectually to drain lands, because the natural outfall was obstructed, either by irregularities of its course, or by the mill-dams or other obstacles interposed. The new Act provides a remedy for this state of things, or at least it is designed to enable landowners to join in improving the common outfall of their particular localities. In the meantime, we cannot refrain from remarking, that it seems strange that so very little should be done in England for the general application of water to agriculture, and that irrigation should practically be confined to a few counties in the west of the island. Sewerage irrigation, from which we were led by Mr Chadwick to expect such wonderful results, has not hitherto fulfilled the promise its advocates made so liberally. For our own parts, we hold that irrigation with pure, or with sewerage water, is sadly neglected in England; and that its extension would confer incalculable benefit on our agriculture. Before leaving this class of subjects, we may also add, that during the discussions of the British Association at Manchester, attention was called by some of the speakers, upon the question of the supply of cotton from India, to a difficulty we have often alluded to, namely, the bad tenure of land in that country. It is known that there are very few districts wherein land can be held in fee simple in our Eastern possessions; and even Colonel Sykes could only urge, in defence of the present state of the real property laws in that country, that there was no restriction as to the description of cultivation, and that practically the land was held on a species of long lease. Until our English system of freehold tenure be introduced, it is to be feared no great progress can be made in the conversion of ordinary agricultural land in India into cotton grounds; and the Manchester Cotton Association is doing good service to humanity, as well as to its own members, in its attacks upon a social organisation which must, in every sense, be injurious, because it places the citizens and State respectively in false positions.

The cotton question is so very serious that everything which bears upon it becomes of importance; and it is, therefore the duty of the technical press to revert constantly to its consideration. At the present there is, moreover, prevalent amongst our rulers an idea that the first and most essential thing to be done, to encourage the growth of cotton in India, is to hasten the completion of railways; and so the resources of England are being severely taxed for that purpose. But the improvement of the irrigation, and of the internal navigation of that country, seems to us to be a matter of more pressing need; because the article cotton is so cumbersome, and yet of such small comparative weight, as to render its transport by railway quite impossible. The distances from the cotton growing districts to the shipping ports of India are so great that the mere transport of the cotton to the latter by any of the known methods of land carriage, must constitute a serious element in its cost to our manufacturers; and it is for this reason that the attention of our engineers and shipbuilders should be earnestly directed to the solution of the problems connected with the steam navigation of the Indian rivers. The Australian rivers present very analogous conditions to those of India; and the future prosperity of those colonies will greatly depend upon the success of the attempts to convert them into means of intercommunication. Boats of light draught, and engines of great power, but small weight, are required for these rivers. Some of the recently built steamers intended for the Indus, the Murray and the Hunter, have made successful approximations to securing those conditions; and it will suffice to call attention to the subject to secure them effectually. There is an unlimited field of operations for the steamship building trade in meeting the wants of our colonies in this matter —hitherto we have confined ourselves too exclusively to the making of railways. It may seem strange, but it really seems to be probable, that the energy which some of the English Railway Companies are exerting themselves to develop their steamboat traffic may give rise to improvements in this branch of construction which may benefit less advanced countries. The competition between the South Eastern, the London and Chatham, and the Kentish Coast lines, cannot, at any rate, fail to elicit new modes of construction, or new forms of machinery.

The oil springs of Canada are likely to furnish a new source of traffic to that thriving colony; and they suggest many curious subjects for speculation, using that word in a commercial or in a technical sense. Whence comes this oil?—does its supply or production throw any light on the formation of coal?—are we to seek in these wells the explanation of such anomalous deposits as the Boghead, or the so-called lignites of Italy and Sardinia? What new uses is it to be turned to? Mr Leslie has lately taken out a patent for extracting certain materials from coal to be subsequently used for the manufacture of gas. May not the American mineral oils be thus applied, and thus save the transport of the bulky article coal? It is said that the wells near the Great Western of Canada Railway Station at Wyoming yield the enormous quantity of 18 millions of gallons per annum. Can this yield be permanent? If so, what revolutions in trade may it not give rise to? Canada seems likely, indeed, to modify many generally received opinions with respect to physical geography, as for instance, in the case of the discovery by Sir Wm. Logan of the Laurentian rocks; its oil springs may, in another direction, turn inquiries towards the interesting subjects now referred to.

The patent taken out by Mr W. J. Hay for a new marine glue is worthy of notice; and, had we room, we would dwell at length upon the recent extensive application of hydraulic machinery in docks and warehouses. Other subjects of great importance to a commercial country like our own must, for the same reason, be passed over cursorily, such as the Harbours of Refuge Act of last Session, and the application of the lime light to the South Foreland Lighthouse. The wonderful improvement in the condition of Ireland might also be advantageously dwelt upon; and indeed the signs of useful, healthy commercial activity to be observed at home only serve to make the comparison between our condition and that of our Transatlantic brethren the more painful. Alas! the lesson to be learnt from contemporary events seems to be that the diffusion of general education, and the development of material prosperity may lead to great social disturbances; and as the constant recurrence of strikes amongst our workmen shows that we are not without reason to fear that similar disturbances may possibly occur here, under given circumstances, it behoves us to take heed how we stand. Instruction is not education; and it is to be feared that much of the so-called educational movement of the day is thus misdirected, and that both masters and men have very unsatisfactory opinions with respect to their relative rights and duties. The subject of strikes deservedly occupied much attention at Manchester; meanwhile, the strike in the building trades continues as bitter as it ever was.

RECENT IMPROVEMENTS IN THE SEWING MACHINE.

Mr Wilson (of the firm of Newton Wilson & Co.), New Oxford Street, and Mr William T. Rowlett, of Leicester, have recently filed a specification of their conjoint invention, relating to improvements in sewing machines, which contains some novelties worthy of note in our pages. The first of the numerous modifications described by these gentlemen in their specification, is a simple and cheap form of shuttle, or lockstitch sewing machine, of which we give a side elevation, at fig. 1, the peculiar shuttle to be used therewith, but which is also applicable to other shuttle machines, being represented in inside elevation and sectional plan at fig. 2. A is a semicircular shuttle race, placed vertically beneath the table or cloth-plate, in the groove of which the shuttle reciprocates. The shuttle, *a*, is shorter than usual; it is pointed at one end, *c*, and is rounded and enlarged considerably at the heel or opposite end, to receive the reel or thread spool, *b*, which is fitted therein upon a pin in the interior of the shuttle. This reel is shorter in the direction of its axis than ordinary shuttle reels, but is of greater depth or diameter, and is placed inside the shuttle, with its axis transversely to the longitudinal centre line of the same, in lieu of being parallel therewith; *d*, is a small blade-spring fitted inside the shuttle, and pressing upon the surface of the thread, which is wound upon the reel, thereby imparting the requisite amount of drag or tension to the thread, which may be further increased by passing the thread through two or more holes in the top side of the shuttle, in the usual manner. B (fig. 1), is a radial shuttle-driver, fast on the stud, C, which receives a rocking motion from the connecting-rod, E. This rod is connected at one end to a short crank arm on the inner end of the stud or spindle, C, whilst its opposite end is jointed by a stud or pin, H, to the rod, F, which works the vibrating needle lever, O. Motion is imparted to this rod, F, and, consequently, to the shuttle-driver and needle lever simultaneously, by the single eccentric, K, fast on the main driving shaft, L. The needle lever is carried by the rocking shaft, I, which carries also a short arm, G, to which the eccentric rod, F, is jointed. The needle-thread is supplied from the bobbin, R, whence it passes between a pair of friction discs, S, through the several guide eyes, T, and thence to the eye of the needle. M is the feed cam, which is so made as to impart the requisite horizontal and vertical movements to the feed bar, X, a spring, P, serving to return the bar after each stroke of the cam, to its forward position. In order to facilitate the insertion and removal of the shuttle into and from its race, the upper part of the driver, B, is made to turn back on a hinge,

Fig. 1.

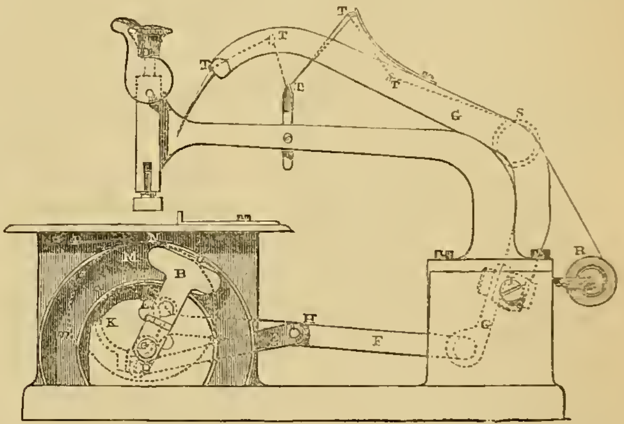
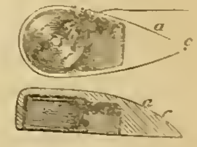


Fig. 2.



and so admit of free access to the shuttle race. Fig. 3 represents a simple and ingenious arrangement of mechanism for stitching button-holes, and ornamenting the edges of fabrics generally. In this machine two slightly curved needles, A *a*, are used, having eyes near their points, and each carried by a separate lever arm, B and *b*, respectively. C and *c* are two bobbins which supply the thread to the two needles. The needle, A, passes upwards through a loop of the upper needle thread, which is held open by any suitable looper for that purpose, and then passes through the cloth. The second needle, *a*, passes downwards outside the cloth, but through the loop of the under needle thread, which has also been previously opened by a slight backward motion of such needle. The lever arm, B, vibrates upon a centre at D, and is held down by a helical spring, E, when not acted upon by the elevating cam, F, fast on the main-shaft, G, which cam comes into operation at the proper time, when the needle is required to penetrate the cloth. The upper lever arm, *b*, is fast on the rocking shaft, H, which also carries a short arm, K, in connection with the rod, L, of the eccentric, M, fast on the main-shaft, G, and which consequently imparts a positive up and down vibratory motion to the upper needle lever. N is a cam for actuating the feed bar, O. If desired, the relative actions of the two needles may be reversed, thus the upper needle may be made to penetrate the cloth in lieu of the lower needle. Q is a botton hole and needle guide situate inside the slit of the button hole, the object and operation of which will be better understood on referring to the detail plan of a button hole in the act of being stitched, shown at fig. 4. This guide, Q, is so fitted into the cloth plate of the machine as to be capable of being either turned up into a vertical position, and so made to project through the button hole, A A, in readiness to receive the needle which passes past the edge of the cloth, or of being turned down out of the button hole so as to lie horizontally and flush with the surface of the cloth plate or table when not in use. The object of this guide, which consists simply of a small grooved or channelled piece of metal, is to keep the button hole open, and admit of one needle working inside the slit, whilst the other passes through the edge of the fabric itself, the needle which works through the slit or opening of the button hole being made to pass through the guiding groove or channel in the guide. Facility is also afforded for adjusting this guide laterally or in a transverse direction to the button hole, so as to enable the needle which pierces the cloth, to enter the same farther from or nearer to the edge of the button hole, and thereby show more or less width of stitching round the button hole. Fig. 5 represents another modification of button hole machine, suitable either for stitching button holes, ornamenting the edges of fabrics, or for producing what is known as the "herring bone" stich.

Fig. 3.

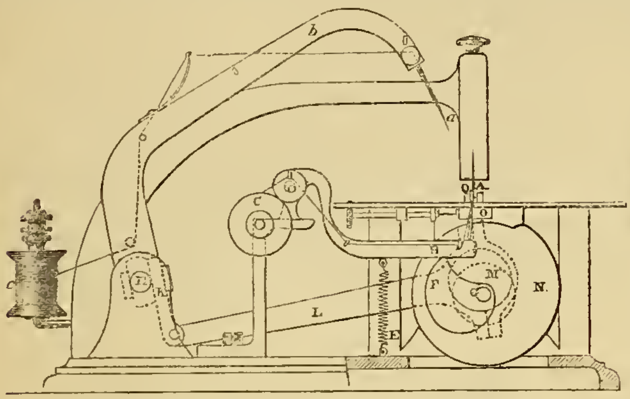
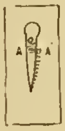
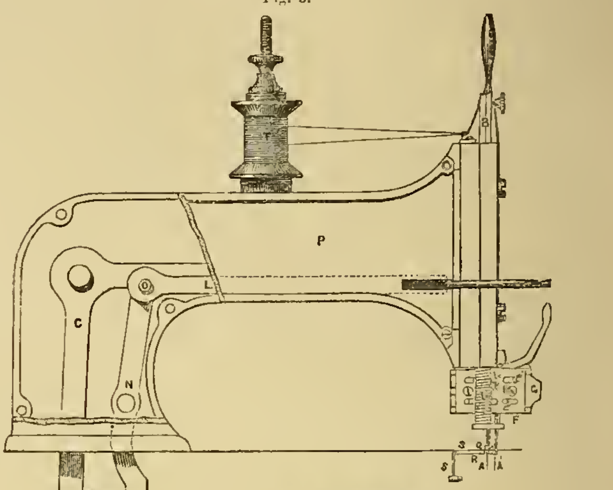


Fig 4.



Our illustration represents the upper part of a Grover and Baker sewing machine modified so as to produce the peculiar description of work above mentioned. A A^1 are two straight grooved needles, provided each with an eye near its point similar to the ordinary sewing needle. These needles are carried side by side and parallel with each other in the single needle slide or holder, B, which is actuated in the usual manner by means of a bell crank lever, C, worked by the cam, D. Each of these needles has a lateral motion of its own in the holder, so as to enable them to exchange places with each other. This is accomplished by securing each needle to a separate lateral slide, E E^1, shown more clearly in the sectional plan of the lower portion of the holder at fig. 6. These slides are carried in a guide or box, F, fitted to the lower end of the ordinary needle slide or holder, B. They are each slightly undulated or corrugated on their contiguous faces, which corrugations lock into each other, the two sides being held together face to face by the bent spring, G. By this arrangement, the slides are permitted to work freely over each other, whilst at the same time the corrugations, by slipping from one indent into the other, ensure the slides always making the proper amount of traverse, and hold them steady after each change of position. Each slide is provided with two pins, *e e*, and *e*^{1} *e*^{1}, respectively, which enter corresponding holes in the slides, H H, which work in grooves at the back of the box, F, being retained in their places by the outer plate, I, provided with slots to allow of the traverse of the pins. K is an oscillating lever working on a fixed centre at *k*, in the side of the guide or box, F, two pins, one on each side of the fixed centre of the lever serving to connect such lever with the slides, H H^1, and E E^1, so that on imparting a vibrating motion to the lever, K, the slides, E E^1, which carry the needles, will slide over each other, the one moving to the right, the other to the left, thereby reversing the positions of the needles. The lever, K, is actuated by the crooked end of the sliding rod, I, which passes out through a slot in the side of the bracket, P, and is actuated by the lever, N, and cam, M. Each needle is supplied with a thread of its own from two bobbins at T. The cloth to be operated upon is laid in the ordinary manner upon the table of the machine, and the slit of the button hole is placed over the guide, Q, (see fig. 4) this guide being carried by a small plate, R, adjustable in a direction to or from the needles so as to regulate the width of the stitching or amount of overlap of the thread over the edge of the button hole. The guide, Q, is fixed on to the end of the wire, S^1, which passes through and turns

Fig. 5.



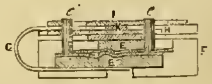
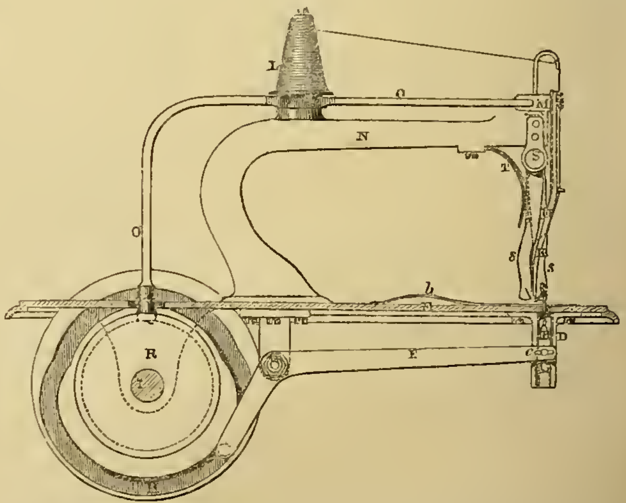


Fig. 6.

Fig. 7.



freely in the plate, R, and is bent down at S, to form a lever arm, whereby it may be partly turned in the plate, R, and cause the guide, Q, to be turned down below the surface of the table out of the way of the cloth when its presence is not required. In stitching a button hole by this machine, one of the needles, say for example, A, descends with its thread through the edge of the fabric, whilst at the same time the needle, A, passes down the guide, Q, within the slit of the button hole, both needles, however, forming loops of their respective threads below the fabric. Through these two loops is passed the loop of a third thread, carried by the ordinary circular needle of the Grover and Baker machine, or by any other convenient looping instrument, which, being well known to all conversant with sewing machines, we have not considered it necessary to introduce in our cut. The two needles then rise, and so soon as they have cleared the cloth, they exchange places with each other, so that the needle, A^1, which previously penetrated the cloth, will at the next descent pass through the slit of the button hole, and *vice versa*, when their loops are again locked by the third thread, and so on until the button hole is completed. A shuttle may be substituted for the looper if desired. The object of the lateral motions, or changes of the needles before their descent, is to cause the thread, which has previously entered the fabric, to be drawn over the edge thereof, and thereby produce the overcast stitching required in this description of work. This peculiar motion of the needles also serves to produce the effect of " herring bone " stitching, when both the needles are made to penetrate the fabric at each descent, the crossing of the two threads thus effected giving an ornamental character to the work. When the machine is required for ordinary sewing, it is simply necessary to remove one of the two straight needles, and turn down the guide, Q, so as to be out of the way of the fabric. Messrs Wilson and Rowlett also propose to accomplish the *darning* of fabrics by machinery, and describe certain simple arrangements of mechanism for effecting that operation, one of which we give at fig. 7. This machine is constructed on the principle of the stocking frame, and produces work or darning precisely similar to the well known stocking weaving, hence its peculiar suitability for the purpose, as in darning a hole in a stocking, or other piece of hosiery for example, the darned part will resemble the rest of the fabric. This machine is provided with a row of any desired number of barbed needles, A, provided with self actors or barb-closers as used in stocking weaving. These needles are fitted into one or more leads, B, carried by the metal slide, C, which works vertically in the fixed guide, D, secured to the underside of the table or bed plate, E, of the machine. As the row of needles rise, they pass up through the fabric, *b*, such motion being imparted to them by the lever, F, which works on a centre at C, and is actuated by the cam, H, a pin and slot, *c*, forming the connection with the slide, C. A thread from the spool, I, is passed along the several barbes of the needles by the thread carrier, K, which is secured to the horizontal reciprocating slide, M, worked by the lever, O, and cam. R, fast on the shaft, I. *s* is a series of sinkers suspended from S, on the bracket, N, and working between the needles, being pushed forwards by the springs, T, and acted upon by a slur cock, U, on the thread carrier. Any suitable feed motion may be applied to the machine for moving the fabric along after each row of stitches has been made. According to another mode of darning, a row of eye-pointed needles are used, slightly curved or bent, so that they will form an open shed when passed through the fabric, each needle being supplied with a thread of its own. Through this shed a filling or locking thread is passed either by the aid of a horizontal needle, or a shuttle, after which the row of needles descends, the darning being similar to ordinary hand darning. Or, by another method, the ordinary warp needles and thread guides may be used similar to those employed in machines for producing hosiery or warp fabrics. In all these darning machines, provision is made for turning some of the needles out of action, so that the number of needles at work will depend entirely upon the width of the darn to be produced.

STEAM AND ITS ECONOMY.

IX.

In the former paper, I stated that there was a mean point of expansion clearly indicated in metals, fluids, and gases, and, by experiment, it seemed as clearly indicated that the law of contraction does not follow the same law as expansion. By many this will not be admitted; but we know it from practical experiment. That we may understand this more clearly, let us suppose an increasing pressure equal to fifteen pounds, indicated by the barometer gauge, and the mercurial thermometer indicating 250.3. Now, suppose the thermometer to be indicating 255, and the gauge indicating 20 lb., let us suppose the heat to be immediately removed, the barometer gauge would, for an instant, indicate an increase of pressure, then contraction would follow, and when the thermometer indicated 250, with a falling temperature, the barometer gauge would not indicate a pressure equal to 15 lbs. From this it is clear, that the pressure of expansion does not follow the same law as that of contraction. The law of contraction is similar to that term which we apply to steam when we reason on its expansion. That we may understand those terms more clearly, let us define them as the pressure of expansion and the pressure of contraction. It may be asked, do I admit the Boiling Law? Yes, under certain conditions, that is, so far as the increase of temperature, but not the decrease, and that all comparisons of the law of increase must be reduced to a standard pressure of 30 inches of mercury; but it does not follow from experiment that if we gradually exceed this, that the same law holds goods for an increasing pressure; for its seems clearly indicated, from experimental observation, that the thermometer by which we determine is not calculated to sustain the general law. That we may understand this more clearly, let us suppose, in the forming of a thermometer scale, that we mark the leading points of the mercury when it is ascending in the tube, and then remark them when descending. We discover that the marks do not coincide. Then, if this be clearly indicated by the thermometer, need we doubt the same law in more volatile fluids. Then a mean of the ascending and descending of the thermometer column must be the indicative power of the expansion and contraction to whatever body it may be applied.

The piston of the steam engine is moved by an effective mean pressure, and its velocity depends on the amount of resistance, and when its motion arrives at a mean, each pound of pressure is moving a resisting pound through as many feet per second. It seems clear, that when the steam has given out its power, that after the first impulse and motion indicated, its impulse of energy begins to decrease in proportion to the amount of expansion. Now, the question is, in reasoning the power of the engine, what is the value of that expansion? for it is not clearly indicated by the diagrams which may be taken from the engine; for we know that the decrease of expansion does not follow the same law as that of the increase, and to calculate the power of the engine from the curve immediately indicated in the diagram will not give the effective mechanical power produced by the piston.

There is another point to be kept distinctly in view, that is, the difference of immediate *impulse* and *pressure*. It seems clearly indicated by experiment, that the first impulse of a body in motion is greater than that at a constant pressure from the same source of energy or power. In the former paper, we stated that there were many good reasons to doubt the opinions of those who affirmed that from a single cylinder, if equal in size to those combined, similar results might be gained.

First, it seems clearly indicated that the first impulse or rebound of the steam is the most effective. Then it would seem evident if this steam is made to rebound two or three times, that the effective power must be greater than that of a continued decreasing expanding pressure; and there can be no doubt but the condensation in the cylinders is less under the combined than that of the single, wrought under high expansion, and where it may not be convenient to keep the cylinder at a high initial temperature, or near to that of the steam, the loss by condensation would be great, as well as the waste of fuel. Much has been said and written in favour of extreme pressures and expansions, but until we are in possession of a more correct instrument for indicating the effective power, we have reason to doubt the amount of saving. The power of the engine might be more correctly indicated by a mercurial thermometer, particularly where a high rate of expansion is used, as the thermometer would indicate a mean point, and by this means we should be in possession of more correct ideas of the amount of economy, and the extent to which expansion might be profitably carried out.

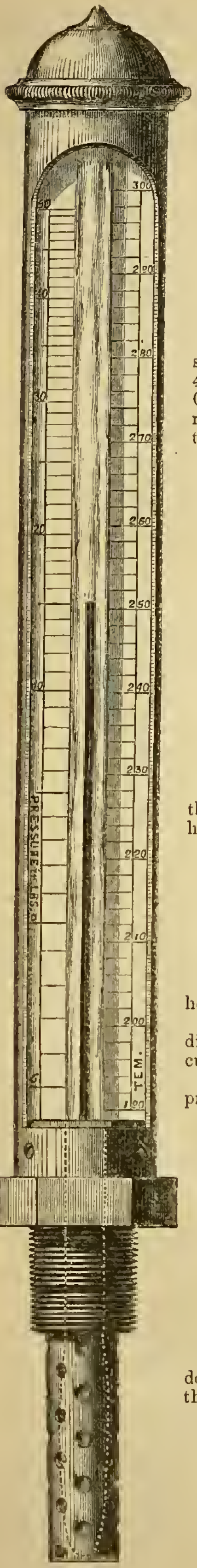
De Pambour's theory, as applied to the steam engine, is based upon the fact, that the temperature of the steam acting in the cylinder corresponds at every instant to its pressure. A mean of the pressure of increase and decrease can only be measured conveniently by the mercurial thermometer. Now, let us suppose a thermometer constructed similar to the annexed engraving, and screwed on to the cylinder cover. It will then indicate the mean heat or temperature within the cylinder, the mercurial column continues to oscillate at the mean point of expansion and contraction, its value in degrees and pounds of pressure will be observed as marked upon the scale, the divisions of pressure on the left hand and the degrees of heat on the right; the divisions under 212 represent pounds under the atmosphere or vacuum, and the divisions above 212 represent pounds of pressure above the atmosphere. The scale constructed in this way will at all times indicate high and low pressures. When using the thermometer in calculating the effective power of the engine, care must be taken that due allowances are made for the working condition of the engine, also the vacuum, steam valves, &c.

The following examples will convey an idea of the methods of using the thermometer pressure gauge :—

To find the power of a steam engine, when the diameter, pressure, and velocity are given.

Rule.—Multiply the square of the diameter by the effective pressure, as indicated, say 8 pounds per circular inch, and this product by the velocity in feet per minute, say 220; divide this last product by 42,000, and the quotient is the horse power.

Example.—The cylinder of an engine is 40 inches diameter, and the effective pressure is 8 pounds per circular inch, the velocity being 220 feet per minute—What is the power of the engine?



40 diameter.
40
1600 square.
8 pressure.
12800
220 velocity.
256000
25600
42,000)2816,000(67 horse power, nearly.
252
296
294
2

Suppose it be required to test the power necessary to drive different parts of machinery witb a 40-inch cylinder, the following is the method:—Calculate the power of the engine by the above rule, at one pound pressure per circular inch, thus—

40 diameter.
40
1600
220 velocity.
32000
3200
42,000)352,000(8·38 horse power, at 1 pound.
336
160
126
340
336
4

Suppose the thermometer indicates 5½ pounds, then multiply 8·38 by 5·5, and the product is the horse power.

8·38
5·5
4190
4190
46,090=horse power, at 5½ pounds pressure.

Method III.—When 33000 is assumed as the horse power, and 220 feet the velocity—

Rule—Multiply ·006667 by the square of the diameter in inches, and by the pressure per circular inch in pounds.

What is the power of an engine 40 in diameter, pressure 5·5 lbs. per circular inch?

·006667
1600 sqr. dia.
4000200
6667
10,667200
5·5
53336000
5333600
58,6696000 horse power.

Or multiply the square of the diameter by double the pressure per circular inch, aud divide the product by 300. Thus—

40
40
1600
11 double the pressure.
300)17600
58·67 horse power.

Let the diameter be 45 inches, and the pressure 15 lbs. per circular inch—

45
45
225
180
2025
30
300)60750
202·7 horse power.

Let the cylinder be 48 inches diameter, velocity of piston 240 feet per minute, and mean pressure 20 lbs. per circular inch.

48
48
384
192
2304
240
92160
4608
552960
20
33,000)11059200(335 horse power.
99
115
99
169
165
4

Let the diameter be 60 inches, velocity of piston 260 feet per minute, and mean pressure 160 lbs. per circular inch—

60
60
3600
260
216000
7200
936000
16
5616000
936000
33,000)14976000(453 8 horse power.
132
177
165
126
99
270
264
6

When tbe diameter of the cylinder, its length, the number of revolutions per minute, and tbe pressure per circular inch are given.

Rule—Multiply the square of the diameter by twice the length of tbe cylinder, by the revolutions per minute, and by the mean pressure, and divide the product by 33,000.

Example.—Given diameter of cylinder, 100. Length, 12 feet; revolutions per minute, 10; mean pressure, 18 lbs.

100 diameter.
100
10000
24 double stroke.
240000
10 revolutions.

2400000
18 pressure.

19200000
2400000

33,000)43200000(1309 horse power
33

102
99

300
297

3

When the pressure is given per square inch.

Rule—Multiply the square of the diameter by ·7854, by twice the length of the stroke, by the revolutions per minute, and by the mean pressure, and divide the product by 33,000.

In the last example let the mean pressure be 23 lbs per square inch.

·7854
10000 square of diameter.

7854
24 double stroke.

31416
15708

188496
10 revolutions.

1884960
23 pressure.

5654880
3769920

33,000)43354080(1314 horse power.
33

103
99

45
33

124
132

Example—Let the diameter be 26 inches, length of stroke 3 feet 4 inches, number of revolutions 28, and pressure per square inch 40 lbs.

26 diameter.
26

156
52

676
·7856

2706
3380
5408
4732

530·93
33 length of cylinder.

1592·79
176·98

1769·77
2

3539 54
28 revolutions.

28316·32
70790·8

99107·12
40 pressure.

33.000)3964284·8 (120·1 horse power.

REPORT OF COMMISSIONERS OF PATENTS FOR 1860.

The number of applications for provisional protection recorded within the year 1860 was 3196; the number of patents passed therein was 2061; the number of specifications filed in pursuance thereof was 1965; the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months of provisional protection, was 1135.

Four thousand patents bear date between the 1st October, 1852, and the 17th June, 1854 (being the first 4000 passed under the provisions of the Patent Law Amendment Act, 1852.) The additional progressive stamp duty of £50 was paid, at the end of the third year, on 1186 of that number, and 2814 became void. The additional progressive stamp duty of £100 was paid at the end of the seventh year on 390 of the 1186 patents remaining in force at the end of the third year, and 796 became void. Consequently, nearly 70 per cent. of the 4000 patents became void at the end of the third year, and nearly 90 per cent. became void at the end of the seventh year.

All the provisional, complete, and final specifications filed in the office upon the patents granted under the Act since 1852 have been printed and published in continuation, with lithographic outline copies of the drawings accompanying the same, according to the provisions of the Act 16 and 17 Vic. c. 115.

The provisional specifications filed in the office and lapsed and forfeited, have also been printed and published in continuation.

The work of printing the specifications of patents under the old law, 12,977 in number, and dating from 1711 to 1852, was completed in 1858, copies whereof are sold in the office at the cost of printing and paper.

Abstracts or abridgments of specifications, grouped under the different heads of invention, are being prepared, and the following subjects have been printed and published:—

Drain tiles and pipes.
Manufacture of iron and steel.
Manures.
Sewing and embroidering.
Preservation of food.
Aids to locomotion.
Steam culture.
Marine propulsion.
Watches, clocks, and timekeepers.
Fire-arms and other weapons.
Ammunition and accoutrements.
Paper, pasteboard, papier mache cards, paper hangings, &c.
Typographic, lithographic, and plate printing.
Bleaching, dyeing, and printing yarns and fabrics.
Electricity and magnetism, their generation and application.
Manufacture and application of india rubber, gutta percha, air, fire, and water proofing.
Production and application of gas, metals, and alloys.

It is intended to publish at the rate of eight or ten series in each year, completing the work in four or five years.

The following subjects are in the press:—

Shipbuilding, &c.
Preparation of fuel and apparatus for its combustion.
Steam engines.
Weaving.
Photography.
Bricks and tiles.
Spinning.

The abridgments are sold in the office at the cost of printing and paper.

From the accounts appended to the report, it appears that the salaries paid to clerks and officers for the year amounted to £6459; that the two law officers divided between them fees amounting to £9621 15s; and that the current and incidental expenses in the Commissioners' office were £5024 12s 4d. The stamp duties paid during the year on patent documents amounted to £108,132 14s 6d, and £1439 4s was received by the sale of prints of specifications. The surplus income is put down at £92,044 17s 4d; but this includes £45,500 18s 10d for the balance of accounts from the 1st October, 1852, to the end of 1859.

NEW PATENT OFFICE.

The following is an abstract of a Report of the Commissioners of Patents on the subject of the Building of a Patent Office, Public Library, and Museum, transmitted to the Treasury in April, 1858.

The 4th section of the Patent Law Amendment Act, 1852, enacts, that "it shall be lawful for the Commissioners of Her Majesty's Treasury to provide and appoint from time to time proper places or buildings for an office or offices for the purposes of the said Act." In pursuance of the requisition of the Lords Commissioners of the Treasury, dated in 1853, the Commissioners of the Board of Works provided certain offices for the Commissioners of Patents, being the ground-floor rooms of the Masters' offices in Southampton Buildings, Chancery Lane, theretofore occupied by Masters in Chancery, abolished under the Act 15 and 16 Vic. c. 80; and an annual rent of £490 is now paid out of the Fee Fund of the Patent Office to the Suitors' Fund of the Court of Chancery for the hire of the same. This arrangement was not considered to be permanent; no lease has been granted, and as these offices are now required for the occupation of the registrars and other officers of the Court of Chancery, due notice has been given to the Commissioners of Patents, requiring them to give up possession so soon as other suitable offices can be procured. These offices were in 1853 sufficient in number and accommodation for the ordinary business of the office. In the year 1855 the Commissioners of Patents established a free public library within their office, containing works of science in all languages, the publications made by the Commissioners, and the works upon patented and other inventions published in the British Colonies and in foreign countries. This library has greatly increased and continues to increase, partly by purchases, but in a great measure by gifts of valuable and useful books. It was resorted to at the first opening by inventors, engineers, and mechanics, as well as by barristers, solicitors, and agents engaged in patent business; it has become a collection of great interest and importance, and the number of readers has so much increased that at this time convenient standing room cannot be found in the two small rooms within the office which can be appropriated to the library. It is the only library within the United Kingdom in which the public have access not only to the records of the patents and inventions of this country, but also to official and other documents relating to inventions in foreign countries, and this without payment of any fee. A largely increased accommodation is urgently required. No suitable building can be found in the immediate neighbourhood of Southampton Buildings, either to be rented or for purchase. The new offices to be provided must be fire proof, for the preservation of the original specifications and other records of the office; the offices now occupied are fire-proof throughout. The Commissioners of Patents are in possession of a collection of very valuable and interesting models of patented machines and implements, as also of portraits of inventors, many of them gifts, and others lent by the owners for exhibition. They are now exhibited daily, and gratuitously, in a small portion of the museum at Kensington, assigned to the Commissioners of Patents for that purpose by the Lords of the Committee of Privy Council for Trade. A museum of this nature necessarily increases, and the number of models now exhibited may be considered as forming only the foundation of a great national museum. The great work of printing the old specifications of patents, with the drawings attached thereto, inrolled in Chancery under the old law, dating from 1623 to 1852, and 12,977 in number, was commenced in 1853, and completed in 1858 All have been fully indexed in series and subjects, and the indexes printed and published. These prints of specifications form about 900 volumes (450 imperial octavo volumes of drawings, and the like number of imperial octavo volumes of letter press.) The indexes form seven imperial octavo volumes. These valuable works have cost, in transcribing, printing, lithographic drawing, and paper, upwards of £90,000. Notwithstanding this great outlay, the balance sheet of income and expenditure for the year 1857, prepared for the annual report of the Commissioners, and laid before Parliament, shows a surplus income from the commencement of the Act, 1st October, 1852, to the end of 1857, of £6000. The balance sheet of income and expenditure for the year 1858 will, no doubt, increase the total surplus to £12,000 or £13,000. The work of printing the old specifications being completed, as above stated, the expenditure on that head ceases altogether, and consequently the surplus income of the year 1859 is estimated at £31,000; adding this sum to the available surplus of £12,000, as above stated, and allowing a margin of £3000, £40,000 may be safely estimated as the sum available for building purposes at the end of the year 1859. The Act of 1853 (16 Vict c. 5) converted all the fees imposed by the Act of 1852 into stamp duties, thereby passing the whole income of the office to the Consolidated Fund. The expenditure of the office is estimated and voted annually by Parliament. There is no appearance of diminution in the number of applications for patents, and they may be safely estimated to continue for future years at 3000 in each year. This number will produce £95,000 in stamp duties, and adding thereto £1600 for the average annual proceeds of sales of printed specifications, the future annual gross income may be taken at £96,600. The gross income is, however, liable to a deduction of £18,500 on account of revenue stamp duties, leaving the real available future income of the Patent-office at £78,100 per annum, or thereabouts. The Patent Law Amendment Act, 1852, (15 and 16 Vict. c. 83) imposed certain revenue stamp duties upon patents. These duties have hitherto produced £15,300 per annum, and that sum has been charged against the office in the annual balance sheet of income and expenditure. These duties are estimated for future years to produce £18,500 or thereabouts. The work of printing the old specifications being completed, as above stated, the yearly future cost of the current specifications, abstracts of specifications, journals, indexes, &c., in letter-press printing, lithographic printing, and paper, will not exceed £17,500 per annum, as contrasted with the average yearly expenditure on those three heads of £39,375 within the years 1856, '7, '8. The Commissioners of Patents are of opinion that it is not expedient to propose to Parliament a reduction of the scale of stamp duty fees imposed by the Act of 1852. They are of opinion that the fees paid upon the passing of a patent are not too heavy; the large number of applications (3000 in each year) accounting for the large amount of income. Any material reduction in the amount of fees would undoubtedly tend to increase the number of useless and speculative patents; in many instances taken merely for advertising purposes. There are 3000 petitions for provisional protection presented in each year, or thereabouts. Of this number 1950 reach the patent, and 550 patents pay the £50 additional stamp duty required at the expiration of the third year; 1450 patents, or nearly three-fourths of the whole, thereby becoming void. Probably not more than 100 of the surviving 550 will pay the £100 additional stamp duty required at the end of the seventh year.* Considering the beneficial results of the additional payment of £50 in sifting useless patents, the Commissioners are of opinion that it is not expedient to reduce the amount, and so long as the surplus can be expended for the benefit of patentees, and that portion of the community which is principally interested in and connected with the practical application to public purposes of discoveries and improvements in science and art. They are of opinion that the surplus income, calculated as before stated, to amount to £30,000, at the end of the current year 1859, and to increase in each succeeding year at the rate of £20,000 per annum, may be beneficially applied in the purchase of ground in a central situation, and in the erection thereon of a sufficiently spacious fireproof building for the Patent-offices and public free library attached thereto; and that the surplus fund may also be beneficially applied in the purchase of ground and the erection thereon of a permanent and spacious building for the Patent Office Museum, sufficient ground being taken for the extension of the building, from time to time, as may be required. This is the more necessary, inasmuch as models of the most interesting and valuable description lie scattered over the kingdom, in many instances constructed at great expense, for legal and other purposes, for which the owners have no present use, and many of which occupy a space inconvenient to them. These models, or many of them, would, as the Commissioners confidently expect and believe, be presented or entrusted to them for exhibition in such museum, provided the public are allowed free access to it at all reasonable times. The Commissioners of Patents therefore request that the Lords Commissioners of the Treasury will be pleased to sanction the application of a sufficient portion of the surplus now derived from the fees paid on patents for the purpose of accomplishing the objects above mentioned, and that with this view their Lordships will be pleased to give the necessary directions to the Board of Works to obtain a proper site for the proposed new Patent Office and Library, to be selected with the approbation of the Commissioners of Patents and with the sanction of the Lords Commissioners of the Treasury, and also to prepare the necessary plans, elevations, and specifications for this purpose, also to be submitted to the Commissioners of Patents for their approval, and to make contracts for the building of the same when approved.

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The report of which the above is an abstract was transmitted to the Treasury in April, 1858, and it was immediately thereafter referred by the Treasury to the Board of Works, with instructions to provide a convenient site for the proposed new offices and library, and to prepare plans and estimates to be laid before Parliament. A site was found in 1859 at the northern extremity of the gardens of Burlington House, and plans and estimates were prepared, being a portion of a design for the appropriation of the whole of Burlington House Gardens for various public buildings. This plan has, however, been suspended or altogether abandoned by the Government, and no other site has been found for the Patent Office Buildings. It is intended to make the Patent Office Museum an historical and educational institution for the benefit and instruction of the skilled workmen employed in the various factories of the kingdom, a class which largely contributes to the surplus fund of the Patent-office in fees paid upon patents granted for their inventions. Exact models of machinery in subjects and series of subjects, showing the progressive steps of improvement in the machines for each branch of manufacture are to be exhibited; for example, it is intended to show in series of exact models each important invention and improvement in steam propellers, from the first engine that drove a boat of two tons burthen to the powerful machinery of the present day, propelling the first-rate ship of war or of commerce. The original small experimental engine that drove the boat of two tons burthen, above referred to, is now in the museum, and is numbered one in the series of models of propellers. The Commissioners are in possession of a large number of valuable models, remaining in their cases, for the reason that room cannot be found for exhibition in the very small space assigned to them in the museum at South Kensington; they are also, and for the same reason, obliged to postpone the acceptance of many valuable models offered as gifts by manufacturers and inventors. The public library at the Patent-office is in the same condition; the books daily increase in number, and many remain in cases, for the reason that shelf room cannot be found, much less room for the readers. The surplus of the fee fund applicable to building purposes amounted, at the end of 1860, to £92,000.

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* 583 paid the additional duty of £50, and 202 the additional stamp duty of £100 in the year 1860.

ON THE ORIGIN AND PROGRESS OF THE PHOSPHORUS AND MATCH MANUFACTURES, BY G. GORE.*

The following is the general process of manufacture of matches as now in use:—The wooden splints for the matches are prepared from the very best quality of pine planks, perfectly desiccated at a temperature of 400° Faht. Each plank is cut into about thirty blocks about eleven inches long, four and a-half inches wide, and three inches thick. A block is fixed with its small end downwards between two uprights, the grain of the wood being horizontal. A frame, having fixed upon its upper surface about thirty lancets one-eighth of an inch asunder, with their points projecting upwards one-eighth of an inch, reciprocates to and fro beneath the end of the block of wood by means of a crank, and in doing so scores the whole of the lower surface of the block with a number of parallel cuts, about one-eighth of an inch apart and one-eighth an inch deep, in the direction of its fibres. Immediately upon this a sharp blade, or scythe, swings round horizontally beneath, and cuts off the scored surface to the thickness of one-eighth of an inch, in the form of square splints four and a half inches long, which fall through a shoot into a room beneath. The block now sinks one-eighth of an inch and the operation is repeated. In this way between two and three millions of splints are readily formed by steam power in a single day. English splints are of two sizes—large and minikins: the larger ones are two and a-quarter inches long (or double-length, as first formed, *i.e.*, four and a-half inches), and the minikins are rather shorter.

In England the splints are square in form, and produced as above; but in Germany they are cylindrical, and are prepared in this shape by placing the small block of wood with the end of its fibres downwards upon a strong plate of steel of larger surface, perforated over the greater part of its surface with holes of the size of the splint, countersunk at their entrances to form cutting edges, and as close together as possible. Great pressure being now applied to the upper end of the block, it is forced through all the holes, and reappears on the lower side of the steel plate in the form of a heap of cylindrical splints.

Returning to the English splints—they are collected as they are cut and measured into bundles of six dozen each by a man who seizes a number of them in his hands from the loose and irregular heap, and by dexterous jerking, knocking, and shaking, arranges them parallel to each other, then places them in a short open gutter or cradle, across which he has previously thrown a piece of string, and when the measure is full to the level of its edges he ties up the bundle, throws it aside, and proceeds with another with equal rapidity. The bundles are then perfectly dried by exposure for several hours in a heated oven.

The bundle of splints are next coated at both ends with sulphur. A quantity of brimstone is melted in an iron pot, and one end of a bundle being quite scorched by contact with a red-hot plate is immersed into the melted sulpher to the requisite depth; then repeatedly swung in the air, to throw off the superfluous sulphur, and rolled violently upon its axis and beaten, to prevent the splints adhering together in one mass as the sulphur hardens. The other end is then similarly treated. In some cases the ends of the splints are saturated with wax instead of sulphur in a similar manner.

A child now arranges the splints in a number of successive rows, one above another, in a frame, each splint separate from the others, in the following manner:—He takes a narrow wooden frame composed of three fixed pieces, a narrow bottom cross-piece about sixteen inches long and two inches wide, with two vertical pegs about eight inches high, one at each end; and has by his side about two dozen loose strips of wood of similar length and width to the bottom piece, and with holes or notches at their ends to receive the upright pegs; each of these strips has a series of fifty transverse shallow notches upon its upper surface to receive fifty splints, and is covered on its lower side with felt or other soft material. Having placed one of these strips upon the bottom piece, he takes up a handful of splints and quickly deposits fifty of them, one in each groove, their ends projecting one and a-quarter inches on each side; he then places another strip upon the first one, and fills it in like manner, and so on until the pile of twenty-four rows is complete. A thicker strip of wood, similar to the bottom piece, covered upon its lower side with felt, is then placed upon the top, and the whole secured moderately tight by means of thumb-screws, or pegs fitting into holes in the uprights. The splints are then ready for being tipped at their ends with the phosphorus composition. Many children are employed at this kind of labour.

The exact ingredients, and their proportions, in the phosphorus composition, differ in different countries and with different manufacturers, but they all consist essentially of emulsions or mixtures of phosphorus in a solution of glue or gum arabic, with or without other matters for increasing the combustibility, for colouring, &c. In England the composition contains a considerable quantity of chlorate of potash, which imparts a snapping quality, and noisy projecting flames, and but little phosphorus, on account of the moisture of the climate; other substances are also added to give hardness and power of resisting moisture. The following is about the composition of the best quality:—

Water	4	parts by weight.	
Glue	2	"	"
Phosphorus	1½ to 2	"	"
Chlorate of potash	4 to 5	"	"
Powdered glass	3 to 4	"	"

In Germany the proportion of phosphorus used is much larger, and gum is used instead of glue, together with nitrate or peroxide of lead, and no chlorate of potash. In consequence of the presence of so much phosphorus and the absence of chlorate of potash, the German matches light quietly, with a mild, lambent flame, and are injured quickly in a damp place by the oxidation of the phosphorus and the production of phosphoric acid, which attracts moisture. One of their mixtures, given by Böttger, is composed as follows:—

Phosphorus	4	parts by weight.	
Nitrate of potash	10	"	"
Fine glue	6	"	"
Red ochre	5	"	"
Smalt	2	"	"

In every case the glue is first broken into small pieces and soaked in cold water until quite soft, then added to the requisite quantity of water and heat applied by means of a water-bath until it is quite fluid, and at a temperature of 200° to 212° F. The vessel is then removed from the fire, the phosphorus gradually added, and the mixture agitated briskly and continually with a stirrer, having wooden pegs or bristles projecting at its lower end. The chlorate of potash, colouring, and other matters, all in a state of very fine powder, are then added, one at a time, to prevent risk of accident, and the stirring continued until the mixture is comparatively cool. By this means the minute particles of phosphorus are kept from uniting into large globules, and the heavier matters are prevented from sinking to the bottom.

In the process of tipping the ends of the matches (termed in the manufactory "dipping,") a quantity of the composition is spread, by means of a large palette-knife, upon the horizontal surface of a smooth stone or plate of iron, heated by means of steam beneath. The mixture becomes much more fluid by the heat, and is spread to a width and length of about ten inches by twenty, and a uniform depth of about one-eighth of an inch by means of a horizontal gauge. The "dipper" then takes a frame filled with splints, as already described, strikes the ends of the splints, upon the bare part of the stone until the whole of those ends exhibit a flat, uniform surface. He then dip those ends, either once, twice, or more times, into the mixture, until they have all received a proper amount, and hands the frame to a boy, who places it upon a rack in a current of air, in order that the composition may cool and harden. Meanwhile the dipper proceeds with other frames in like manner, and replenishes the layer of composition occasionally. After a number of frames have been thus dipped, and the composition upon the splints in them has partly hardened, they are all taken, one by one, in the original order, and the other ends of the splints tipped in a similar manner. With six dipping-stones, half-a dozen workmen have dipped as many as twenty millions of matches in a single day. This method of dipping is termed "frame-dip;" but there is another process called "bundle-dip," which consists in taking a bundle of the sulphured splints, twisting it in such a manner that the ends of the splints spread out like a brush and separate from each other; they are then tipped with composition like the others. In this process the *ends* only of the splints acquire a coating of the mixture, whereas in frame dipping the composition extends a short distance up the *sides* of the splints and is more firmly attached. Bundle-dipped matches are inferior to frame-dipped ones.

In the manufacture as now being described it will be observed that each splint is 4½ inches long, coated with composition at both ends, and will therefore form two matches by being cut asunder in the middle; but this is not always the mode of proceeding; in some manufactories the splints are cut in two before being dipped, and are tipped at one end only.

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* From the *Chemical News.*

As soon as the composition is partly dry, and of such a degree of hardness as to bear the next operation without igniting and without rubbing off, the splints (those coated at both ends) are quickly removed from the frames into parallel heaps, and the frames set at liberty. A man now takes a heap of fifty of the splints, places them between two vertical supports in a horizontal channel or through a trough of wood, passes a string with a weight over them to prevent their falling about, and cuts them through at their middle by means of a cork-cutter's knife, moving upon a hinge like a chaff-cutter's scythe. He then places them in heaps of 100 matches each, ready for boxing. The little boxes are now filled by women and children, who perform the operation with exceeding rapidity, and before the matches are dry, in order to avoid accidents. Each match passes through the hands of about seventeen persons, chiefly children, in its process of manufacture.

Trays of sawdust are placed near the various workmen and operators to plunge the matches into in case they ignite. Vessels of water are also freely at hand in case of accident. Also a quantity of sand is strewed in a layer of several inches deep beneath the racks upon which the frames of matches are set to harden, so that in case of a frame of matches falling, the flames may be quickly extinguished. A lotion, composed of olive oil and lime water, is exceedingly useful to apply to the skin in cases of burning by phosphorus.

The latest improvement of note in the manufacture of matches is that of M. Lundstrom, of Jonkoping, in Sweden. It consists in dividing the ingredients of the match mixture into two separate compositions, one being placed upon the ends of the splints as usual, and the other, which contains the phosphorus, being spread in a thin layer upon the end or lid of the box. The patentee uses the following mixture for the splints:—

Chlorate of potash - - - -	6 parts.
Sulphide of antimony - - - -	2 to 3 "
Glue - - - - - - - -	1 "

and the following for the friction surface, which has been previously made rough by a coating of glue and sand:—

Amorphous phosphorus - - -	10 parts.
Sulphide of antimony or peroxide of manganese - - - - -	8 "
Glue - - - - - - -	3 to 6 "

By this method the danger of fires arising from ignition of the matches by friction is avoided (because the matches will ignite by rubbing upon no other surface besides the prepared one); and that of poisoning is totally prevented by using the red or innocuous variety of phosphorus.

There is scarcely any manufacture of which the statistics appear more fabulous than that of match-making. To begin with England, in which the manufacture is comparatively small. The firm of Messrs Dixon, Newton Heath, employ about 300 workpeople on the premises, and upwards of 100 at their own homes. Their stock of timber is generally of the value of £8,000, or £10,000. They consume 1 ton of sulphur per week, in the sulphuring of splints; and in twelve months they use between 4 and 5 tons of chlorate of potash, and 12 tons of glue. They produce about 43,000,000 of matches every week, or 2,160,000,000 matches yearly; reckoning the length of a match at 2¼ inches, the total length of these would far exceed the circumference of the earth. In London, a single saw-mill cuts up 400 large timbers annually to make splints for matches. It has been estimated that from 12,000 to 15,000 gross of boxes of matches are produced weekly in London, indicating a production of 5,000,000,000 of matches yearly in that city. And another calculation has been made that the whole length of waxed cotton wicks consumed by one London manufacturer in the production of "Vestas" would be sufficient to reach from England to America and back again. One pound of phosphorus is sufficient for tipping 1,000,000 of German matches, or for 600,000 English ones. The yearly consumption of phosphorus in the manufacture of matches in this country has been estimated at 6 tons, which, at a price of 2s 6d a pound, amounts to a value of £1680; and of chlorate of potash, 26 tons. A single merchant of London imports 8000 cwt. of cases of matches yearly. In 1854, £20,000 worth of matches came into this country from the city of Hamburgh alone. We import at the present time at least 1500 tons of matches a-year from Sweden only. It has been estimated that £60,000 worth of matches are imported yearly into Great Britain,—equal to 200,000,000 of matches daily; and that our daily consumption approaches the enormous number of 250,000,000, or more than 8 matches each day for every individual in the kingdom. In Belgium, the consumption of matches has been calculated to be 9 matches per day for every living person. In France, the manufacture of matches is very extensive. Paris alone employs 1000 operatives, and produces 990,000,000 of boxes, worth in total £7200 yearly. In Sweden there are 6 or more manufactories of matches; in one of them, in 1848, there was employed about 400 workpeople, and produced between 8,000,000 and 10,000,000 of matches daily. But the greatest seat of match-making is located in Austria, where there are numerous manufactories which produce many millions per day of phosphorus matches; for instance, those of M Pollak, at Vienna, and M. Furth, in Bohemia, consume together about 20 tons of phosphorus annually, and give employment to about 6000 persons; and as one pound of phosphorus suffices for upwards of 1,000,000 of their matches, those two makers alone produce the amazing number of 44,800,000,000 of matches yearly. In the year 1849, there was exported from the port of Trieste alone nearly 200 tons of lucifer matches, and the whole produce of matches in Austria in that year was estimated at 2500 tons. The cost at which both boxes and matches are produced is equally startling. M. Fürth sells his cheapest boxes at one penny per dozen, each box containing 80 matches. Peter Harrass, of Suhl, in Prussia, sells his plain boxes at twopence per 100, and 1400 splints for one farthing. And De Majo, of Moravia, sells a case of 50 boxes, each containing 100 lucifers, for fourpence.

SEMI-DRY CLAY BRICKMAKING MACHINE.

William Wilson, Esq., *Campbellfield, Glasgow.*

Illustrated by Plate 279.

Great is the difficulty which the brickmaker experiences in conducting his business in wet and frosty weather. The large amount of space required to spread the soft and plastic clay on the ground, or in dykes, where it must remain many days exposed to all the inclemency of the atmosphere, makes his business one of great anxiety in stormy seasons; and often does he find the work of a fortnight irreparably damaged and swept away in one night. In the making of fire bricks the cost of erecting stoves is only equalled by the incessant outlay for fuel to heat them. In this way bricks are dried artificially, but not so well as by the atmosphere, and at a cost for fuel reckoned generally to be as great as that required for firing them in the kiln.

To make a brick capable of being stacked in the kiln and burned forthwith, is the object of the process we are now about to describe. It has been the aim of some inventors to compress DRY clay into bricks under enormous pressure, and their success has been indifferent. The process we are now about to describe has been invented by Mr Wilson, of the Campbellfield Brickworks, Glasgow. In it the dry pulverised clay is *prepared* for the pressure it is intended to receive by being pressed through a chamber filled with steam, when it is partially softened and rendered plastic by the condensation of the steam to such a degree as is deemed necessary, and then it is found that a very moderate pressure comparatively is required. This is considered a very important part of the invention, and to be accompanied with very important results. Another feature we would direct attention to in the machine which we are about to describe is the hydraulic pad or buffer piston which, acting between the brick and the compressing cam, regulates the amount of pressure to be given with perfect accuracy. In this way the machinery is neither stopped nor broken when meeting with stones, or a mould that contains too much clay. Breakages are unknown; a uniform pressure is obtained on each brick; and the bricks are afterwards regulated to one size before leaving the machine. In the kiln it is also found that these bricks have no tendency to fly to pieces, as is found to be the objection in many methods of brickmaking. We shall now proceed to describe this automatic brickmaking machine, which has been recently patented by the inventor.

The main cross beam, A, which sustains the actual pressure of forming the brick, is supported by four malleable-iron columns, B, screwed at their upper ends, and each fitted with two nuts, so that the cross beam, A, can be accurately adjusted to the proper height. At one end of the cross beam, A, two open cast-iron frames, C, are bolted, one on each side, and serving as diagonal stays to the cross beam, A. These frames or stays are keyed on the sole plate against snugs cast thereon, and by these keys can also be accurately adjusted to suit the proper height of the cross beam, A, in the centre of which is formed the upper journal for the central upright shaft. A circular disc of cast-iron, D, the upper surface of which is truly faced in the lathe, is keyed firmly upon the central upright shaft, and is supported by a footstep bracket bolted to the sole plate in the centre of the machine. This disc, D, is accurately divided into 14, 16, or any other number of holes somewhat larger than the size of the bricks to be moulded, and into each of these cased holes is fitted a die corresponding exactly with the size of the brick, and in accordance with the number of moulds formed in the disc or moulding table, D. An equal number of moveable plungers, E, are fitted and guided during the revolution of the mould table by means of an annular ring, F, supported upon the brackets, G, bolted on to the sole plate. Upon this annular ring, F, an incline is formed so as to raise and retain the compressing plungers, E, at the required height during their semi-revolution from the one automatic plunger, H, to the other. The cylinder, I, into which the automatic pressure plunger, H, works, is fitted with a cup leather similar to those used for the Bramah press, and in connection with the cylinder a small safety valve, lever, and salter's balance is fitted so as to regulate the required pres-

SEMI-DRY CLAY BRICK MAKING MACHINE,

WILLIAM WILSON ESQ^RE

CAMPBELLFIELD BRICKWORK, GLASGOW.

PATENTEE.

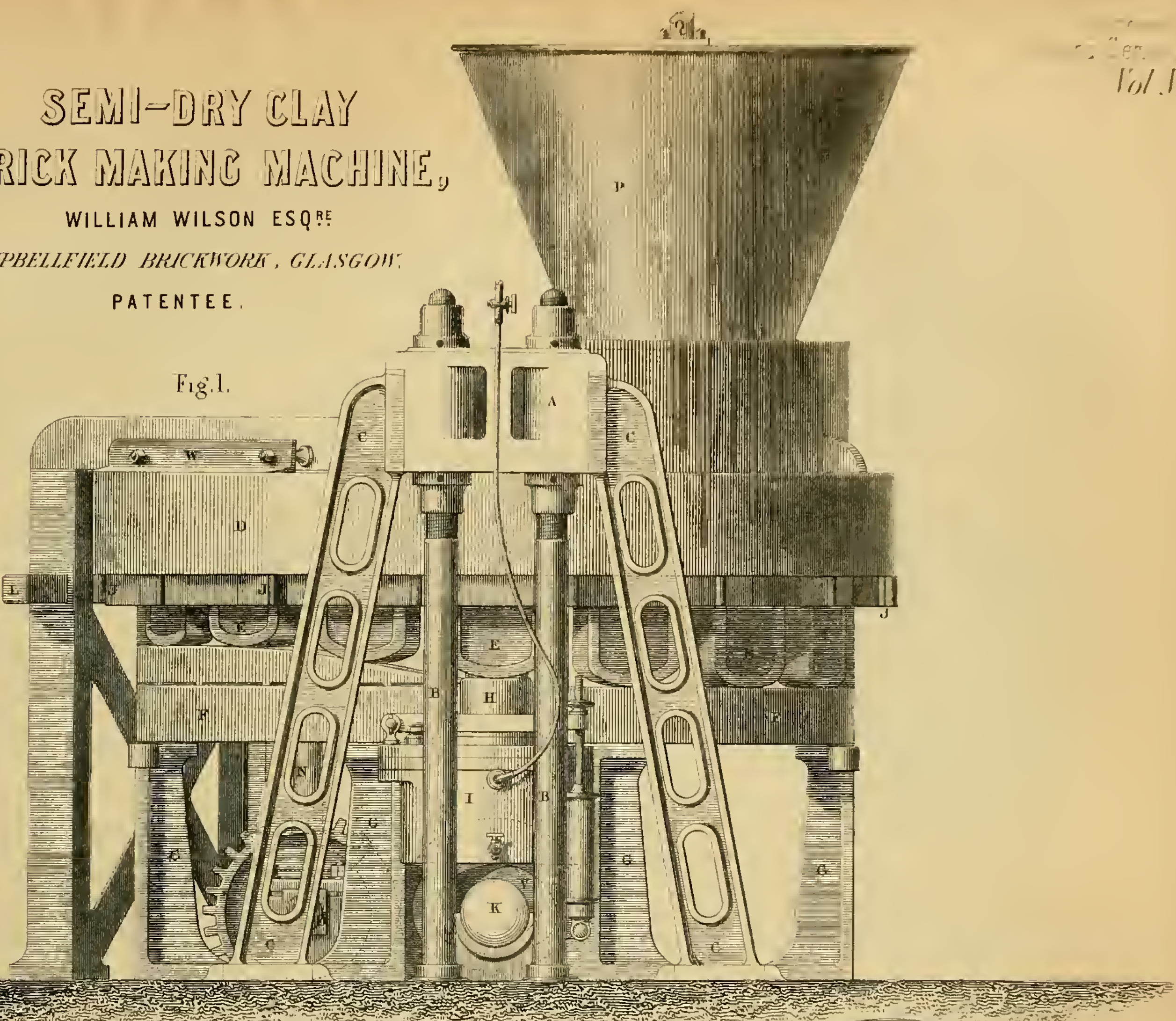

Fig. 1.

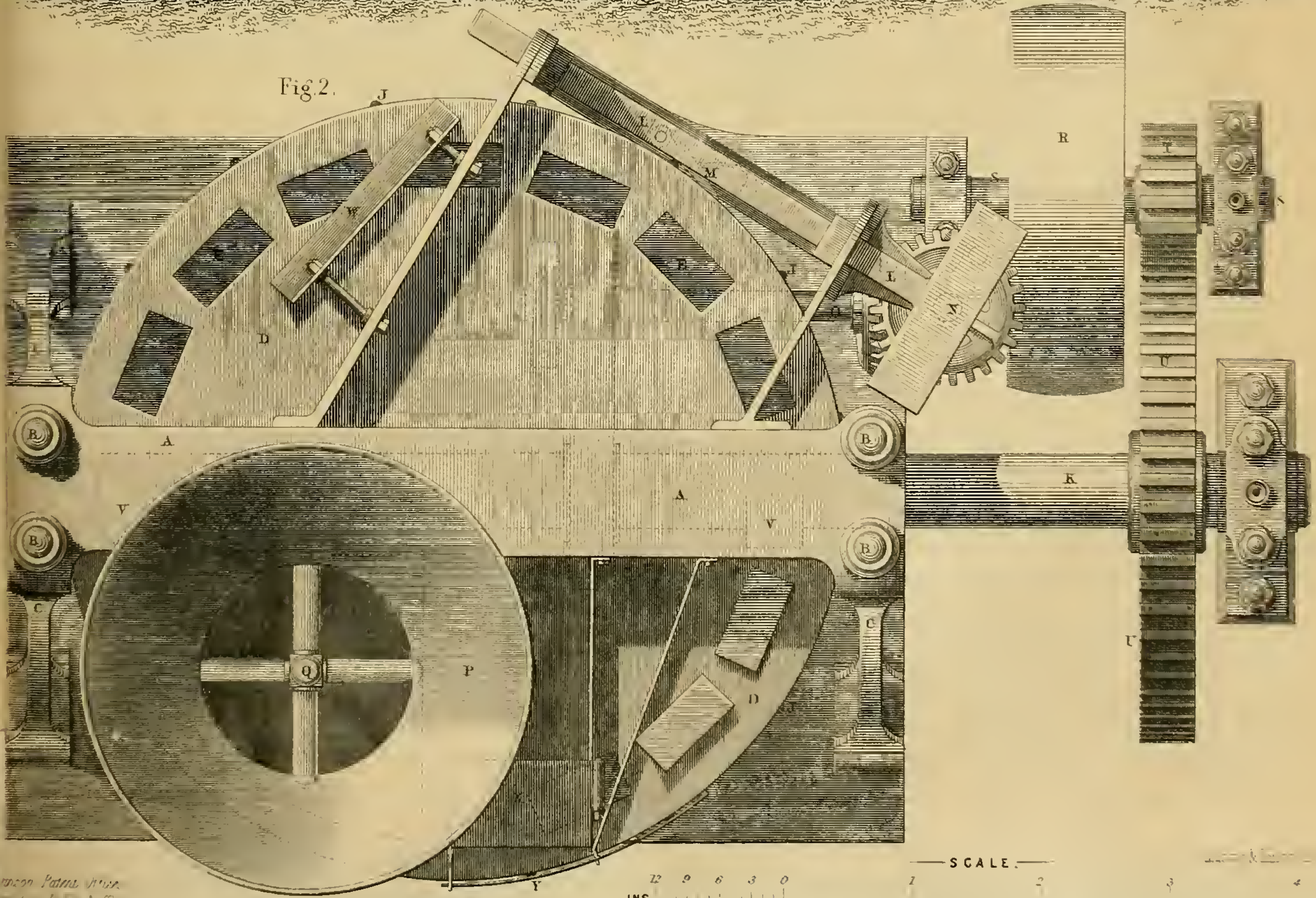

Fig. 2.

— SCALE. —

12	9	6	3	0	1	2	3	4

INS. FEET.

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sure, and to prevent any undue strain during the compression of the clay. Around the periphery, and on the lower side of the deep disc, or moulding table, D, a series of snugs or teeth, J, are formed or attached, corresponding with the number of moulds formed in the moulding table, and at each revolution of the main shaft, K, a small crank, shown in dotted lines in the plan, fig. 2, gives a rectilinear motion to the sliding bar, L, which is fitted with a catch and spring, M, which gears into the teeth, J, on the return stroke of the bar, L, so that by this means the moulding table receives an intermittent motion, turning only that fraction of its revolution which corresponds with the number of moulds in the moulding table. The motion to the small crank on the upper end of the upright shaft, N, is obtained through the intervention of a small horizontal shaft, O, parallel with the main shaft, K, turning in pillow blocks bolted or formed on the sole plate. This shaft, O, has keyed on one end a spur wheel, in gear with an equal sized spur wheel keyed on the main shaft, K, and at the other end a pair of mitre wheels gives motion to the upright crank shaft, N, so that these three shafts make a simultaneous and an equal number of revolutions. Above the moulding table, and near one end of the cross beam, A, a hopper, P, is fixed, which receives and guides the soft clay into the moulds as they pass underneath. Within this hopper an upright shaft, Q, carrying four knives or blades, is kept in continual motion, so as to prevent the clay from settling therein, as also to fill the mould thoroughly during its short stoppage underneath the hopper. The machine receives motion from any prime mover by means of a belt turning the pulley, R, keyed on the horizontal shaft, S. On one end of this shaft the pinion, T, is keyed, and gears into the large spur wheel, U, keyed on one end of the main shaft, K, upon which two cams, V, are formed, which at each revolution raises the cylinders containing the automatic plungers simultaneously. At each end of the machine, and diametrically opposite each other, these cylinders are placed, and they rise and fall in slides formed on two of the brackets, G, supporting the annular guide ring, F, the first cylinder, being that nearest the eye in fig. 1, of our Plate, gives a certain compression to the soft clay in the mould, which then remains in the mould until the moulding table has made one half of a revolution; it then receives the final compression from the cylinder at the other end of the machine. The brick is now forced out of the mould by means of its respective compressing plunger, or punch, E, gliding up an angle surface formed on the annular guide ring, F. So soon as the brick is out of the mould, the moveable compressing punch or plunger falls to its lowest position, leaving the mould ready for a new charge of clay so soon as it passes underneath the hopper.

One very important feature in this machine is the automatic compressing plunger, H, contained within the cylinder, I, which no doubt has rendered this machine superior to its predecessors. The action of this detail of the machine is such that no matter what substances should enter the mould, the cylinder, I, although raised to the working height by the action of the cams on the main shaft, cannot give a greater pressure to its plunger, H, than the salter's balance is loaded to; for so soon as the limit of pressure is exceeded, the safety valve will rise and allow the water contained in the cylinder underneath the plunger to escape, and thus prevent any accident which otherwise would inevitably occur.

Several of these machines are now daily at work, and from what we have witnessed of their performance, Mr Wilson's invention has been highly successful.

RECENT PATENTS.

SCREW PROPELLERS & MARINE ENGINES.

Robert Wilson, *Manchester.—Patent dated January* 15, 1861.

The improvements specified under these letters patent relate to the arrangement and construction of screw propellers, marine boilers, and engines.

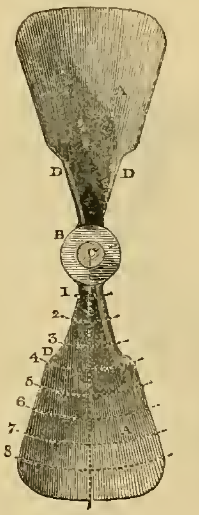


Fig. 1

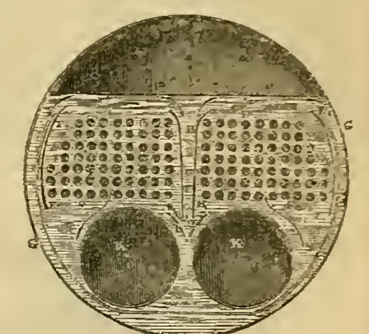


Fig. 4.

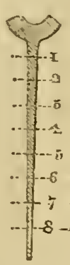


Fig. 2.

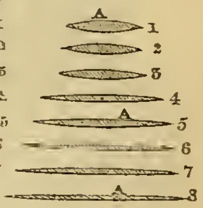
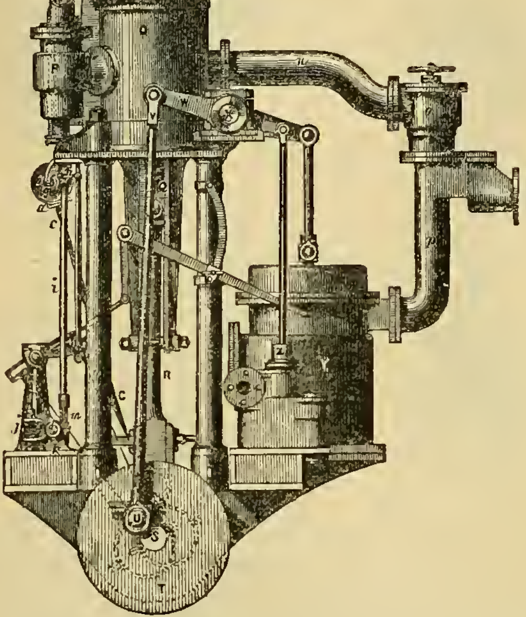


Fig. 3.

Fig. 1 of the accompanying engravings is an elevation of a screw propeller constructed according to the patentee's improvements. Fig. 2 is a partially longitudinal section of the same; and fig. 3 is a series of transverse sections taken through the lines marked 1 to 8 in fig. 1. Referring to figures 1 to 3, the blades of the screw propeller are formed so as to approximate as nearly as possible to the form of the geometrical figure which is known as the solid of least resistance. The object of this arrangement being that the propeller shall move through the water without disturbing it, and with the least possible resistance. To accomplish this end, the blades, A, of the propeller are made with both surfaces corresponding in their curvature, as shown in the transverse sectional views, fig. 3. Thus, near the boss, B, of the propeller, the metal of the blade in its transverse section on the line 1, forms a long and comparatively narrow ellipse having pointed extremities. From this part outwards to the margin, the blade becomes gradually thinner, and the elipse is lengthened in proportion, so that on the line 8 the two surfaces become very nearly parallel; and thus, from the margin of the blade to the boss, no resistance whatever is offered to prevent the particles of water from gliding smoothly away. So also, if the longitudinal section of the propeller blade be taken as an example of this system of construction, it forms, as shown in the sectional view, fig. 2, a narrow, wedge-shaped figure, the best adapted for passing easily through the water. The boss, B, of the propeller is formed as small as possible consistent with the necessary degree of strength; and to obtain this, combined with the smallest amount of weight, the propeller is preferred to be made either of steel or of wrought-iron. Where it is practicable, it is preferred to use steel for the propeller shaft, C, in order that the increased tenacity of this metal may admit of a corresponding reduction in the diameter of the shaft. The blades, A, are narrowed at the part, D, by cutting away a portion of the metal; this admits of the angle of the blades being more easily changed to the required angle, and adjusted to the slip so as to save power, and not disturb the water during its rotatory motion. If made of steel, these improved propellers will not require more than one-half the weight of metal as compared with cast-iron or brass; and if wrought-iron is the material made use of the weight need not exceed five-eighths of the weight of a similar propeller formed of cast-iron or brass. In this way, then, speed is gained by the improved form of the propeller, the little resistance that it offers in its rotatory movement enabling it to pass through the water as smoothly as though it were penetrating a comparatively solid body. This facility of motion is also attended with another advantage, for it effects a considerable saving in the amount of steam power required to impart to the propeller a given number of revolutions. In this way, not only is the speed of the vessel greatly improved by the use of this form of propeller, but from the smoothness of its motion the highly unpleasant vibration ordinarily imparted to the vessel when the screw propeller is driven at a high velocity is altogether avoided. The arrangement of boilers which the patentee prefers to use in conjunction with the engines of screw propellers is represented in the transverse sectional view, fig. 4. This view shows the patentee's improvements in preventing "priming," and also the arrangement for superheating the steam. To prevent priming, two curved plates, E, are arranged longitudinally within the boiler; they are fitted outside the tubes, F, and parallel or nearly so to the shell, G, of the boiler. Between the two ranges of fire tubes, F, are fitted the two vertical plates, H, which diverge slightly from each other towards the upper part. Beneath the plates, H, are arranged the two narrow, diverging plates, I, which run nearly parallel with the curved surfaces of the furnace tubes, K, a narrow, longitudinal opening being left at the lower part of the duplex plates. As the water is heated by its contact with the tubes, F, and flues, K, the heated portions ascend and displace the water of lower temperature, which is thus caused to descend in a current between the plates, E, and the shell of the boiler, and also between the central plates, H. The descending current of water circulating between the plates, E, and the shell of the boiler is thus brought into contact with the highly-heated surface of the tubular flues, K, whilst the current which is descending between the plates, H, comes into contact with the diverging plates, I, is by them diffused over the more highly-heated surfaces of the flues, K. This arrangement of the plates thus provides for a continuous and uniform circulation of the water, and the mode of bringing the less heated portions in contact with the flues, K, so raises the temperature as to effectually prevent priming. The steam as it is evolved passes off through a pipe into the steam chest or annular space surrounding the lower part of the chimney; here it gains an accession of heat from the body of highly-heated gaseous matters passing off from the furnaces. The heat thus imparted is further augmented by causing the steam to pass through the tubular coil of copper pipe, which is arranged within the lower part of the chimney. The steam passes in at the upper end of the tubular coil, and out through the lower part of the steam chest to an external valve, by means of which its supply to the engine is regulated. If preferred, a second steam pipe is fitted in direct communication with the upper part of the boiler, which conveys the saturated steam into a valve box arranged in connection with the pipe proceeding from the valve box of the superheating apparatus. In this way, the superheated and the saturated steam may be mixed or blended on their way to the engine, and supplied thereto in the proportions found most economical in working. Fig. 5 is an elevation showing the arrangement of the engines, which Mr Wilson prefers to use for the purposes of screw propulsion. On the sole plate, are arranged four tubular columns supporting an entablature on which the cylinders, O, are arranged. The steam passes from the steam pipe into the valve boxes, P, in which are fitted the rotatory expansion valves, for which letters patent were granted to Mr Wilson and J. W. Child in 1853. By means of these valves, the steam may be cut off at any portion of the stroke, and the mechanical arrangement for effecting this will be presently referred to. The piston rods, Q, work out through the usual stuffing boxes in the end covers, and are connected by means of the rods, R, to the crank shaft, S. On one extremity of this shaft is a disc, T, in which is fitted a crank pin, U, which serves to connect it by means of the rod, V, and lever, W, with the horizontal shaft, X, which is carried in pedestal bearings arranged on the entablature. From the shaft, X, the air pump Y, as also the feed and bilge pumps, Z, are worked. The disc, T, has a series of holes formed in its periphery to admit of the crank shaft being turned by means of a hand lever when the engines are not in motion. This arrangement is very useful either for adjusting valves or to ship or unship the propeller, and for other purposes. To the opposite extremity of the crank shaft, S, is keyed a bevel wheel, which gears with pinion, on the lower extremity of the oblique shaft, *c*; the footstep and collar bearings of this shaft are carried in brackets projecting laterally from the sole plate and entablature. The bevel pinion, *d*, on the upper extremity of the shaft, *c*, gears with the wheel, *e*, on the horizontal shaft, *f*, which extends across the front of the engine. On the shaft, *f*, are two screw wheels, *g*, which give motion to the corresponding wheels, *h*, on the valve spindles, *i*, and in this way a uniform rotatory movement is communicated to the valves in the boxes, P. The vertical adjustment of the valves for the regulation of the "cut off" is obtained from the worm or endless screw, *j*, which is carried in a bracket arranged on the sole plate, N, and is actuated by means of a winch handle. The worm, *j*, gears with a worm wheel, *k*, on the horizontal shaft, *l*, extending across the engine and parallel with the shaft, *f*, above it. The shaft, *l*, has fitted to it two small pinions which gear respectively with the vertical racks, the upper parts of which form the footstep bearings of the spindles, *i*. Thus, by simply turning the worm, *j*, the valve spindles and their connected valves are simultaneously raised or lowered at pleasure whilst the engines are in motion. The steam, after performing its work in the cylinders, passes away by the exhaust, *n*, which opens into a valve box, *o*, in which is fitted a stop valve; the lower part of the valve box opens into the discharge pipe, *p*, which communicates with the hot well in the usual way. Engines arranged according to this plan are particularly well adapted for screw propulsion, as they occupy but comparatively little space, and are free from vibration; they are also easily accessible in all the parts.

Fig. 5.



STEAM ENGINES.

J. A. Shipton, *Wolverhampton.—Patent dated January* 28, 1861.

Mr Shipton has for many years past perseveringly followed up, and improved upon, his original ideas in the management of his pendulous reciprocatory steam engine. Under this patent he has embodied his latest improvements, which are as follows:—

Fig. 1 of the subjoined engravings is a transverse vertical section of the patentee's improved pendulous reciprocating steam engine, showing the piston at half stroke; and fig. 2 is a longitudinal section taken at right angles to fig. 1; but showing the piston in its highest position. Fig. 3 is an end elevation of the piston of the engine, and fig. 4, a side elevation, showing it in its highest and lowest positions and details of construction The sole-plate, A, of the engine is of a rectangular figure, with a curved or segmental recess formed to admit of the oscillatory traverse of the steam chamber or "cylinder." At each end of the sole-plate, A, are strong columns arranged opposite to each other; to these columns the main cross beam, B, is firmly secured by means of bolts and nuts or other equivalent fastenings. The beam, B, is bored at the central part to receive the gudgeon, C, which is firmly fitted into hollow trunnions, C, of the steam chamber or "cylinder," which suspends the steam chamber or "cylinder," D, and which corresponds in its office to the cylinder of a steam engine arranged on the ordinary principle. The interior of the steam chamber approximates to an ellipse, as shown in the longitudinal

Fig. 1.

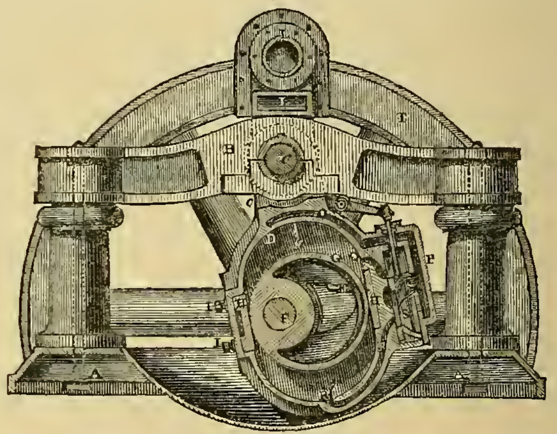
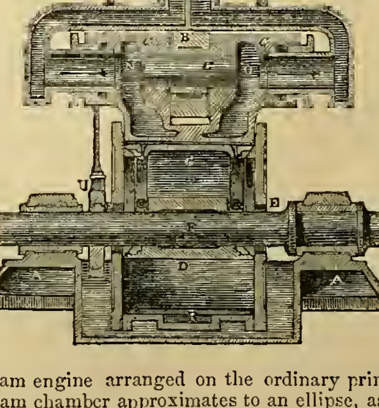


Fig. 2.



section, fig. 1, the ends of the steam chamber or "cylinder" being enclosed by plates having elliptical openings, E, and through these openings, E, the main shaft, F, passes, and which is carried in pedestal bearings arranged on the sole-plate, A. On the shaft, F, the piston, G, is firmly keyed; this piston is of a cylindrical figure in its vertical section, and the shaft passes through it eccentrically, as shown in figs. 1 and 3 of the accompanying engravings, so that when impelled by the steam it traverses from end to end of the steam chamber, at the same time communicating a rotatory motion to the main shaft, and the steam chamber or cylinder vibrating in its bearing in the main cross beam, B, to allow the full side of the eccentric piston to traverse from top to bottom, and *vice versa* of the steam chamber. The periphery of the piston, G, works in steam-tight contact with the vertical plates, H, which are arranged parallel to each other at the central part of the steam chamber, D. One of these plates is fitted in a dovetailed groove formed in the inner face of the steam chamber, and the other in a recess which admits of it being set up tightly against the periphery of the piston from the outside by means of the screws, I. Another mode of arranging this part of the piston consists in introducing the slide blocks, J, between the plates, H, and the periphery of the piston, the side wear being compensated by the plates, J, being jointed together and elongated by a wedge, K, and the wear against the periphery of the piston being compensated by the plate, H, being set up by the screws, I. The ends of the piston, G, are also fitted with double rings, which are forced out by means of wedge pieces and nuts, as shown in fig. 2, and which are readily got at for tightening up through the elliptical openings, E. The steam is conveyed to and from the steam chamber, D, by means of the pipes, L and M, which are curved over the ends of the oscillating trunnions, C, the ends of the pipes, L and M, branch off laterally, and pass through stuffing boxes fitted in the extremities of the trunnions, C, which open in the steam and exhaust passages, N and O, communicating with the slide valve chest, P. In the position in which the piston, G, is delineated in fig. 1, the steam is passing into the upper part of the chamber, D, through the port, Q, and by its pressure on the piston, is forcing it in a downward direction, whilst the steam below the piston has escaped through the port, R, and slide valve, S, to the exhaust, M, as indicated by the arrows. The pressure of the steam on the piston, G, causes it to descend from the upper part of the steam chamber to the lower, and make a partial revolution in its axis, which causes the steam chamber to swing or move in a lateral direction to the right. Upon the position of the slide valve being reversed, the steam passes into the lower part of the chamber, D, and forces the piston in an upward direction, which movement carries the steam chamber over to the left. In this way the piston is caused to move continuously in a rotatory direction, and impart a corresponding motion to the shaft, F, on which the fly-wheel, T, is keyed, the rotatory motion of the shaft, F, being communicated in any convenient way to the machinery to be driven, or other purpose to which the motive power of the engine is to be applied. The slide valve, S, is worked by means of the eccentric, U, on the shaft, F, the upper end of the eccentric rod is connected by a lever to the horizontal shaft, V, which is carried in bearings fitted on the steam chamber, D. A lever at the centre of the rocking shaft, V, is attached to the upper extremity of the slide valve spindle, so that the movement of the eccentric imparts the required reciprocatory motion to the slide valve.

Fig. 3.

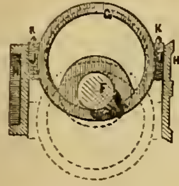
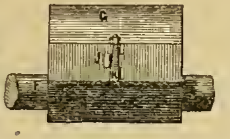


Fig. 4.

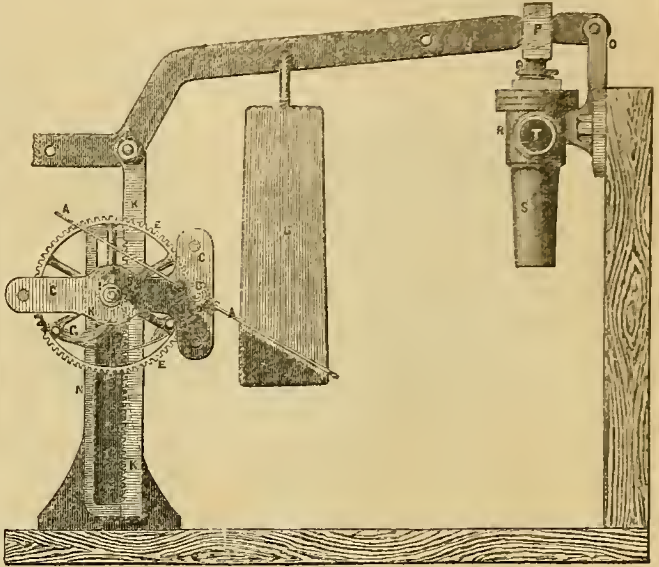


APPARATUS FOR REGULATING THE SUPPLY OF WATER.

George Eskholme, *Rotherham.—Patent dated March* 6, 1861.

This invention relates to an arrangement of apparatus for regulating the supply of water to water closets, wash-hand basins, and for other purposes where an occasional or intermittent supply is required, whereby a certain regulated supply of water is obtained without unnecessary waste or loss. According to this invention, rotatory vanes are employed, which are kept in motion by the descent of a weighted lever in connection with the plug of the cock, or the water supply valve, thereby retarding its descent, and consequently regulating the quantity of water that is allowed to flow.

The subjoined engraving represents a side elevation of the improved apparatus. The rotatory vanes, A, are fast on the end of the spindle, B, which revolves freely in the bracket supports, C, and is provided with a pinion, D, gearing into the spur-wheel, E. This wheel is fitted loosely upon the revolving spindle, F, and carries a spring detent, G, which takes into the ratchet teeth of the wheel, H, fast upon the spindle, F. The spindle, F, carries also a spur pinion, I, which is actuated by the rack, K, suspended at L from the valve lever, M. N is a guide rod or frame which is secured to the rack, and passes down the opposite side of the spindle, F, so as to keep the rack teeth in gear with the pinion, I. In place of the rack, K, and guide, N, a toothed quadrant connected to the lever, M, in a similar way as to the rack, K, at L, and gearing into the same pinion, I, may be used. The lever, M, works on a fulcrum at O, and is connected at P to the valve spindle, Q, of the water supply valve, R, of which S is the inlet pipe, and T the outlet pipe leading to the basin of the closet, or to any other locality where the regulated supply is required. U is a weight suspended at any suitable point on the lever, M. When the lever, M, is elevated by raising the pull or handle of the closet, for example, the valve is opened, and a feed supply of water is directed through the basin, &c. The raising of the lever, M, elevates at the same time the rack, K, and of course rotates the pinion, I, and spindle, F, but without rotating the vanes, as the wheel, E, which gives motion to them, is loose upon its spindle, the ratchet wheel alone rotating whilst the detent slips over the teeth thereof. On the release of the lever, the weight causes it to descend, and this descent is controlled by the retarding action of the rotating vanes, which are now set in motion through the engagement of the ratchet wheel with the detent, G, on the spur wheel, the motion of the ratchet wheel being of course in the reverse direction. By this retarding action of the vanes, the lever is allowed to descend very slowly only, and consequently the valve, R, is gradually shut in lieu of being closed at the instant the pull or handle is released, thus ensuring the supply of a proper quantity of water to the closet, or vessel to be supplied.



BEARINGS FOR SHAFTS AND AXLES.

J. H. Johnson, *London and Glasgow*—(Jose Gallegos, *Paris*).
—*Patent dated Feb.* 11, 1861.

This invention relates to a peculiar construction and arrangement of bearings and grease boxes for rotating shafts and axles of all kinds, which improvements are also applicable to the bosses of wheels intended to run loose upon fixed axes, whereby a considerable reduction of friction is effected and economy of lubricating material obtained. According to this invention, it is proposed to employ a number of antifriction rollers, which are fitted loosely on to separate and independent axes of their own, and so disposed inside the grease box as to leave a space in the centre of them, into which space the main journal of the shaft or axle is introduced, resting upon the peripheries of the lower antifriction rollers of the circular series.

The grease box is packed so as to be grease-tight, and is kept always full of oil or other suitable lubricant, so that the rubbing surfaces are constantly immersed in lubricating material. Openings may be made in and through the antifriction rollers, so as to allow the oil to circulate freely all round. These rollers, which it is preferred to make of steel, may, if desired, be made so as to bear upon the journal at their extremities only, the centre or middle portion being of a slightly reduced diameter; and in order to lower the cost, the ends or working parts only may be of steel, whilst the central portion is of cast-iron, with suitable apertures, and the three parts are bolted together by longitudinal bolts so as to form one roller. In the case of wheels which turn loosely upon their axes, the same arrangement of rollers may be applied to the naves or bosses of such wheels, in which case they will revolve round the axle journal as well as rotate on their own individual axes. Suitable provision is made for inspecting the state of the oil supply by having small glass-covered apertures in the oil chambers, and this applies equally to the fixed bearings for rotating shafts and to the bosses of wheels running loose on stationary shafts or axles.

Fig. 1 of the accompanying wood engravings represents a transverse vertical section, and fig. 2 is a longitudinal vertical section of a bearing or plummer block constructed according to this invention. Fig. 3 is a sectional elevation of one of the antifriction rollers mounted on its axis, shown detached, and to a larger scale than in figs. 1 and 2. Fig. 4 is a similar view of an antifriction roller composed of three distinct parts, by which mode of construction the cost of these rollers is greatly reduced.

Fig. 1.

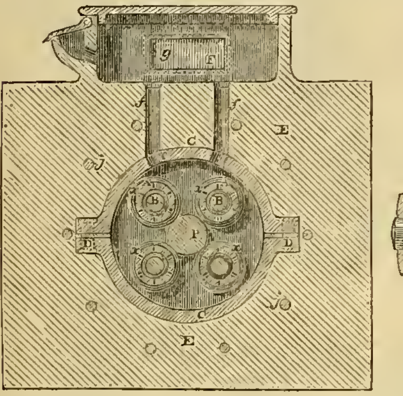
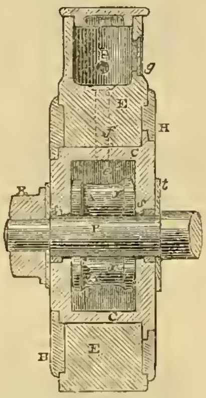


Fig. 2.



The grease box, c, is made in two parts, united by bolts passed through the lugs or flanges, D, between which a packing of leather, caoutchouc, or other suitable material is introduced for the purpose of keeping the joint perfectly grease-tight. The two parts of the box being thus united they are inserted into a frame, E, which may be either fixed or moveable, according as the journal of the shaft or axis is moveable or fixed. In the rolling stock of railways, and in other vehicles where the axles rotate, the axle box is fixed in suitable guide plates so as to be capable only of a slight vertical movement; in this case the frame, E, of the axle box may be of any convenient shape, and carries on its upper surface an oil or grease reservoir, F, in communication with which are the two passages, *f*, made in the frame, E, and corresponding with other openings, *e*, *e*, made in the grease box, c, by which arrangement oil or grease is conducted into the interior of the grease box, so as to surround or envelop the rollers and axle journal contained therein. *g* is a piece of glass, which may be inserted into the side of the oil reservoir for facilitating the inspection of the oil and enable the same to be maintained always at about the same level near the centre of the glass. When the shaft is fixed, the grease or axle box constitutes the boss of the wheel, and in this case the frame, E, is made square, and the oil passages, c and *f*, are disposed upon each of the four faces, so that at whatever part the wheel stops, one of the reservoirs will be uppermost, so as to allow of the amount of oil contained in the box being examined, and of a further supply, if desired, being introduced. The axle box, c, is retained in its place in the outer frame, E, by the two metallic rings, H H, which overlap the edges of the axle box, and are bolted firmly to the frame, E by the bolts *j*. On each face or side of the axle box, c, there are made a series of apertures, disposed exactly opposite to each other; the diameter of the apertures in the one series corresponds with that of the axes, B, of the antifriction rollers, terminating in a head, *b*, as shown in fig. 3, whilst the diameters of the opposite set of apertures correspond with those of the reduced end portions of the axes above referred to. The antifriction rollers, A, may either be made of one single piece of steel, as shown in fig. 3, or they may be composed of three parts, as shown in fig. 4.

Fig. 3.

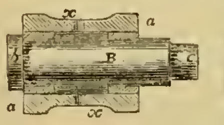
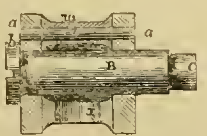


Fig 4.



In the first arrangement the two ends, *a*, are of larger diameter, as these parts alone act as rollers, whilst the middle and interior parts are reduced in diameter, and are made hollow, as shown, the oil being allowed to circulate through the rollers freely by the orifices, *x*, made on the surface thereof. The ends of the roller rest upon the axis, B, either by having a shoulder at the ends, or by inserting a steel ring inside the roller at each extremity, which last-mentioned arrangement is shown at fig. 3. These rollers, may, however, be made much more economically in the following manner:—A steel cylinder is turned down to the desired diameter of the discs, *a*, and from it are cut the discs or rings, *a*, of the proper thickness or width, as shown in the sectional side view at fig. 4. The middle length or section, *w*, of the roller may be made of cast-iron, of the form shown in the same figure, wide openings, *x*, being left in order to allow the oil to pass and circulate freely, and bolt holes, *z*, made for the purpose of enabling the end steel discs, *a*, being secured firmly to the middle portion, *w*. These rollers are adjusted inside the box, c, and are retained or secured therein by passing through them and through the sides of the box the small axes, B; the journal, P, is now inserted between the series of rollers, A, and rests solely upon the enlarged ends or discs, *a*, of those rollers, which rotate on their axes during the rotation of the journal. The openings which exist between the shaft and the axle box are packed by means of india-rubber packing rings, *s*, and leather discs, *t*, are further added, so that the oil, in spite of the rotation of the shaft, cannot escape from the interior of the axle box. R, is a nut terminating the axle, and serving to adjust the box thereon. It is obvious that the rollers might be disposed in mathematically correct positions, in such a manner that the journal, P, should rest precisely upon the peripheries of the discs, *a*. As the centres of the fixed axes are outside, the mounting is rendered very easy, and the parts may be set up as fast as wear takes place, by giving a quarter or half turn to the heads of the axes, B.

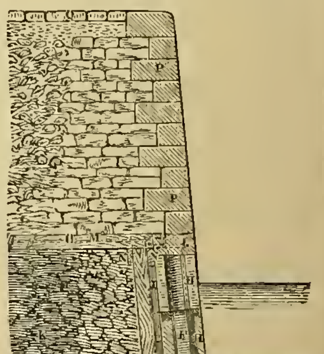
BREAKWATERS AND SUBMARINE WORKS.

Daniel Miller, *Glasgow.—Patent dated Sept. 18, 1861.*

The patentee has in his specification described some highly important improvements in building breakwaters and other similar structures in an economical yet effective and substantial manner.

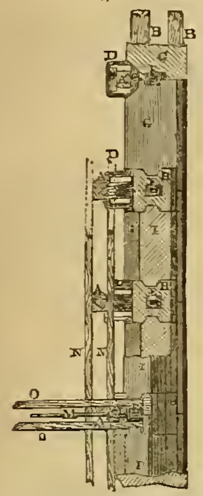
Fig. 1 of the accompanying engravings is a transverse vertical section of one mode of constructing a breakwater, pier, quay, or other generally similar structure according to these improvements. Fig. 2 is a horizontal section of a portion of the structure. In constructing a breakwater, pier, or quay, according to these improvements, the bed of the sea, or river where the structure is to be built may be first deepened as may be found necessary, in the line of the intended structure, by means of a dredging machine, to form a channel for receiving a foundation or layer of concrete or hydraulic cement. A number of wooden piles, A, are driven and arranged in the line of the intended work, and at any convenient distance asunder. They are driven as nearly as possible at the same angle as is intended to be given to the walls of the structure to be erected. These piles are for the purpose of fixing and setting in position the guide frame, B, which consists of blocks of timber arranged in two parallel lengths, and are united by the cast-iron guides, c, or other suitable attachments. On the upper side of the frame, B, the flanges of the guides are let into the frame so as to present an even surface throughout its length. The guide frame, B, is brought up to the outside of the piles, A, which are supposed to stand considerably above the surface of the water, and when in this position the buckles, D, are passed round the piles, A, and attached to the frame B. The frame is then lowered down under water in any convenient manner, and set on the bed of the sea or river, or on to the artificial foundation formed for the purpose. When in this position, wooden keys, E, are driven in between the buckles, D, and the inner faces of the piles, A, so as to connect the frame, B, firmly to the primary piles. When the guide frame is properly fixed in position, it forms a correct gauge for the subsequent operations. The guide piles, F, are then lowered into the water, and are brought one by one over the guides, c; and when the lower extremity has passed into the guide, the pile is driven down. These piles may be formed

Fig. 1



of wood or iron, but preference is given to the latter material. The piles, F, are designated guide piles, because they serve to guide down into their proper position the several blocks of masonry which form the outer walls of the structure. The guide piles, F, are arranged at convenient distances asunder, this distance being made to suit the length of the blocks of stone of which the walls are to be formed. The blocks of stone, G, are made of uniform length; each block has formed at the ends a rectangular groove equal to the width of the guide piles, F, and in depth equal to half the thickness of the pile. The several stones as they are to be deposited are raised by means of suitable tackle or hoisting apparatus above the piles, F, to admit of the stone passing down between its pair of guide piles. The vertical grooves in the ends of the stone admit of its readily sliding down between the piles, whilst they serve to guide it accurately to its predetermined position. The upper courses of masonry may, in like manner, be laid with great rapidity and precision. A number of rectangular blocks, H, are prepared. These blocks have a central aperture made in them to admit of their sliding freely down the guide piles, F. The blocks, H, have also a dovetail groove formed at each end. A number of these blocks are slid down over the piles, F, until the accumulated number reaches to about the surface of the water. These blocks now form guides for placing in position the intermediate blocks, I, which are formed with dovetail ends corresponding to the grooves in the guide blocks, H. The pillars of masonry formed by the blocks, H, serve to guide the blocks, I, down to their proper position, and in this a solid, smooth, and well-jointed sea-wall is quickly raised. If preferred, the dovetails and grooves may be reversed. The top of each guide block has fitted to it an iron cap, L, having a laterally projecting socket piece to receive the end of the tie rod, M, which is keyed or otherwise secured to the socket. These rods serve to bind the whole of the structure together at the upper part, or instead of this arrangement timber may be used for the purpose. In this case it is preferred to attach to the piles, A, lengths of timber, N, extending longitudinally, as shown in the plan, fig. 2, and to the guide piles, F, transverse stringer pieces, O, thus binding the whole firmly together. When the dovetailed system of masonry has been carried up a little above high water mark, the grooves formed on the guide blocks, H, and the dovetails or projections on the intermediate blocks, I, may be dispensed with. As the wall is formed, concrete, or other suitable material, as shown at J, is deposited at the back of the wall in any convenient manner. After the guide blocks have been arranged on the piles as high as the surface of the water, or to the top of the guide piles, F, the further building of the walls, as at P, may be carried on in the usual manner.

Fig. 2.



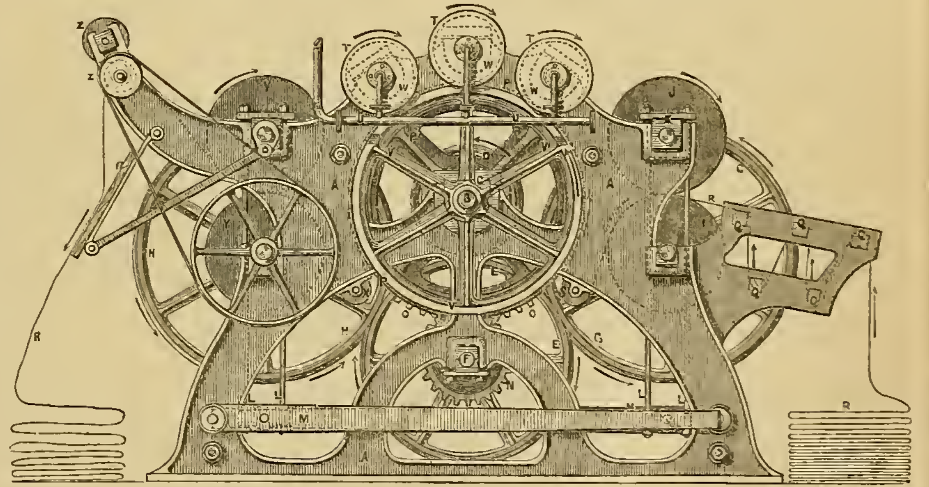
The guide frame is by preference formed of double balks of timber laid closely together, and rectangular openings are made in the frame to receive the ends of the guide standards. These standards are by preference formed of cast-iron; the lower flanged end of each fits into the sockets formed in the guide frame. The blocks of stone, G, forming the lower course of masonry, are made with a groove at each end to admit of being guided down to the frame by the standards. The stones, H, of next course are made with rectangular openings in the centre to admit of their being slipped over the guide standards, and run down to the required position. Increased rigidity may be given to these structures by placing the guide standards nearer together, and forming openings in each block of stone. The blocks being made to break bond with each other by passing one course of stones over the standards, so that each pair of standards pass through the block. In the succeeding course of masonry, the blocks are passed on to the next pair of standards, which brings the abutting ends of this course of blocks over the centre of the lower blocks, and so throughout the structure. This system of building sea walls with the aid of guide piles or standards may be modified in various ways without departing from the essential features of the invention. Instead of using natural stone for the outer casing of the wall, blocks of artificial stone may be used for the purpose. These are formed of a combination of hydraulic lime, cement, or other suitable materials, moulded to the required figure. In this way breakwaters, piers, the submarine portions of fortifications, and other generally similar works or structures, may be constructed with accuracy, rapidity, and economy, without the necessity of using cofferdams.

FINISHING TEXTILE FABRICS.

James Robertson, *Glasgow.—Patent dated Jan. 31, 1861.*

Mr Robertson's invention comprehends the arrangement and construction of a new machine for imparting a softer as well as superior finish to those textile fabrics which require to be subjected to operations at present in use for the purpose of imparting a proper degree of lustre thereto.

The subjoined illustration represents an end elevation, showing one modification or arrangement of a finishing machine, constructed according to the patentee's improvements. The framing, A, of the machine consists of a pair of open end standards connected by longitudinal stay rods. The main driving shaft, B, has upon its outer extremity a fast-and-loose pulley (not shown in the engraving), but which derives its motion from the steam-engine or other prime mover. The shaft, B, is carried in deep tubular bearings, which are fitted in the ends of a secondary hollow shaft, C; the bearings of this hollow shaft are arranged in the upwardly curved parts of the end standards. On the solid shaft, B, is keyed a grooved frictional wheel, D, which is in gear with the larger grooved wheel, E; this wheel is carried on the shaft, F, that is arranged below the shaft, C, in a vertical line therewith. The wheel, E, gears with the two large grooved frictional wheels, G and H, the former of which is keyed to the shaft of the lower intake roller, I, and imparts motion thereto. The upper intake roller, J, is driven by frictional contact with the roller, I; the shaft of the roller, J, is carried in adjustable bearings so as to admit of regulating the pressure of the roller upon the lower one at pleasure. Resting upon the upper bearing is a metal plate, K, which forms a small cross head, through which are passed two tie rods, L, that serve to connect it with a cross head, carried on a stud projecting laterally from the lever, M. This lever extends across the machine, and parallel with the end standard, A, and is centred upon a stud into it, a corresponding arrangement being fitted at the opposite end of the machine. Parallel with the lever, M, but arranged outside the end standard, is a second and similar lever for adjusting the pressure of the delivery rollers, and which will be referred to when describing that portion of the machine. This arrangement of levers applies to both sides of the machine, and consequently pressing equally on both sides of the upper rollers, J and V. The pressure of the upper intake roller, J on the cloth is regulated by suspending a weight on each of the levers, M, and moving them more or less out to the extremity of the levers. The shaft, F, has keyed to it inside the frictional gearing a toothed pinion, N. This pinion gears with the spur wheel, O, which is fast to the hollow shaft, C. The tubular shaft, C, has fitted to it the large central wooden drum or cylinder, P, and which derives its motion from the pinion, N, and wheel, O. Extending outwards in front of the end standards are brackets, in which are fitted the tensional bars, Q, that extend across the front of the machine. The cloth, R, which is to be submitted to the action of the finishing machine, is passed over and under the tensional bars, Q, as indicated by a shark line and arrows. From these bars it passes between the intake rollers, I and J, under the tension roller, S, and over the main drum, P. At this part of



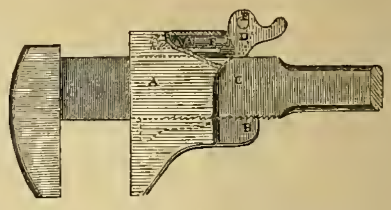
its passage the cloth is subjected to the action of the three finishing rollers, T, which may, or may not, be similar in their general arrangement and construction, according to the finish required, or the nature of the fabric to be operated upon. These rollers are by preference formed of galvanised iron; the rollers are hollow, and they have hollow spindles carried in bearings arranged in the upper parts of the end standards. The hollow spindle of each roller is fitted with stuffing boxes at one end for the admission of the steam-pipe, U, and at the other for a pipe and stop-cock to carry off the water of condensation. This latter portion of the details is not delineated in the drawings, as such an arrangement is well understood. The several rollers, T, or a portion of them, are covered with wire, for the purpose of producing a soft, thready, elastic and watered finish on the cloth, thereby avoiding the hard papery finish produced by the use of ordinary calenders. This wire is wound in a helical direction on the roller, commencing at the centre of the roller, and winding the wire closely out to the end, then winding again from the centre out to the opposite extremity of the roller. In this way, when operating upon the cloth, these rollers tend to smooth or extend the cloth out upon either side on the drum, P, and at the same time they impart a very superior finish to the cloth. The steam for heating the rollers passes into them through the triple-branched pipe, U, and in each roller is arranged a pipe for carrying off the water of condensation. This pipe passes from the hollow spindle down to the inner surface of the roller. The pressure of the steam forces the water of condensation through the outlet pipe, which is carried out beyond the driving gear, and terminates in an ordinary cock. Rotatory motion is communicated to the finishing rollers, T, from the large frictional wheel, V, on the end of the first motion shaft, B. The periphery of this wheel gears into the three frictional pinions, W, which are fast to the spindles of the rollers, T, so that the rollers, T, when in gear, rotate at a much higher velocity than the drum, P. The pinions, W, are made with single grooves, and these grooves are adjustable by means of loose end plates, and are lined with vulcanised india rubber, so as to admit of different thicknesses of cloth passing through the machine, as well as the tensional arrangement of the several rollers being adjusted without the wheel, V, getting out of gear with the pinions, W. One or more of the rollers, T, may be ungeared as required so as to suit the particular kind of finish to the fabric under operation; the roller or rollers ungeared being driven by frictional contact with the cloth and the drum, P. These finishing rollers, or a portion of them, may, if preferred be formed of glass. The peripheries of these glass rollers may be either smooth or corrugated in manner similar to the corrugations produced by covering the roller with wire. In some cases it may be desirable to impart to the rollers, T, a lateral reciprocatory movement. This may be conveniently done by suitably elongating the hollow spindles of the rollers, and fitting on one extremity a disc set at an angle; two antifriction rollers, which are carried in a forked arm, projecting laterally from the end standards, press against the faces of the angularly set disc. The rotatory motion of the rollers causes the discs, by their angular arrangement on the spindles, to move the rollers to and fro in a lateral direction. This lateral movement of the rollers may also be accomplished by means of various other mechanical arrangements. After being subjected to the operation of the rollers, T, the fabric passes under the tensional roller, X, and out between the rollers, Y, which are arranged in all respects in manner similar to the intake rollers, I and J, the lower one being driven by the frictional wheel, H, which derives its motion from the wheel, E. The heating of the rollers, T, may not be necessary in all cases, as the high velocity at which the finished rollers, when in gear, are driven, may render the heating of them superfluous. Finally, the cloth is carried through the delivery rollers, Z; the lower one of these rollers is driven by an endless belt, which derives its motion from a pulley on the shaft of the lower roller, Y. The cloth as it issues from between the rollers, Z, is laid in folds beneath by the reciprocatory movement of the folder, *a*, which is actuated from a crank, *b*, on the extremity of the shaft of the upper roller, Y. With these improvements, the finishing of textile fabrics of various kinds is accomplished in a very superior manner, and with great rapidity and ease.

REGISTERED DESIGN.

LOCK SPANNER.

Registered for Messrs Drury, Brothers & Walker, *Don Tool Works, Sheffield.*

The purpose of utility to be secured by the shape or configuration of this design is the obtainment, by simple means, of a secure grip in the implement called by mechanics a spanner. The annexed drawing represents a side elevation of the spanner, with a portion of the moveable jaw broken away, for the purpose of more clearly showing the arrangement. A, is the moveable jaw which has teeth or notches, B, formed on the lower part thereof at one side, which teeth or notches gear into corresponding teeth or notches formed at the corresponding side of the body, C, of the spanner. D, is an eccentric thumb-piece which works on a centre, E, and is acted upon by a spring and bolt, or slide, F, which cause it to bear or act as a wedge upon that side of the body, C, which is opposite to the notched side, thus keeping the teeth above referred to in gear, and consequently preventing the moveable jaw from accidentally slipping. The parts of this design which are new and original are those marked, D, E, and F.



CORRESPONDENCE.

THE LAW OF PATENTS.

There appeared recently in the *Times* a leading article on the subject of the Law of Patents, suggested by some observations made by Sir Wm. Armstrong in an address delivered by him at a meeting of mechanical engineers at Sheffield. It appears that Sir Wm. Armstrong is of opinion that the existing law of patents throws obstacles in the way of the progress of invention. He thinks that inventors suffer from over protection. He believes that a patent law might be altogether dispensed with, and that the inventor would fare best if, like the producer, he was left by the State to make what he could of his invention, "without any attempt to give it by law an unnatural and artificial value." The writer of the article considers Sir Wm. Armstrong's authority as especially valuable, because he is one of the class for whose benefit the patent law has been framed. He is a man of patient industry and careful thought directed to successful issues. Yet such a man comes forward to say that, judging from his own experience, a patent monopoly is a mistake as regards inventors, and a wrong as regards the public. He would have free trade in invention as well as in commerce.

Sir Wm. Armstrong's authority, however, is not quite so high in this matter as the *Times* may suppose. Inventor as he is, and valuable as his inventions may be, it is well known that he has ceased to have any immediate interest in them. He has been able to dispose of them at a good price to the Government of the country. If any one pirates them, what wrong is done to him? And why should we expect him to feel an interest in property that is no longer his?

But the question is not one to be argued on personal grounds. It involves points of large public interest, and I will ask your permission to devote a little space to its consideration.

First, let me remark, that primary ideas or bare principles are not patentable. A patent for a mere scheme is of no value whatever in the eye of the law. It is only when a practical mode of carrying out some scheme has been discovered that a patent for it can be enforced in a Court of Justice. The philosopher who discovers some new principle of nature is not allowed to secure the monopoly of that principle—it is only when he has shown its practical importance, by embodying it in some useful machine, or process, or manufacture, that he is allowed to obtain a valid patent for it. The object of such a rule is evident. The whole aim of a patent law is the encouragement of invention for the benefit of the public. A principle, as long as it remains a mere principle, is of no use either to the discoverer or to others, and therefore a law which would secure it, and all its possible applications to the discoverer, would be of no benefit either to the inventor or the world. Those applications may be very numerous and important, but until they are pointed out they can hardly be said to exist; and no one, not even the discoverer, ought to have the power of debarring others from turning them to account.

This being settled, what principle of justice is there in refusing a patent privilege to those who have expended time, and money, and mental labour in putting into practical form some scheme by which the labour of others is saved, or their material wants gratified? If a man writes a book, does not the law give the property of that book to him, and warn the rest of the public that they have no right to make themselves masters of a single copy without the writer's consent, express or implied? And why is not a man's invention in mechanical or chemical art to be secured to him in the same way? To say that there are inconveniences attending this view of the subject is beside the question. Of course there are. Inconveniences to some extent attend all monopoly, all property. The point for our consideration is whether these inconveniences are of such a nature as to outweigh the benefits which induce the public to saddle itself with a patent law.

If the public promises to an individual that he shall retain for his own benefit for a short number of years any invention which he may arrive at, it holds out a strong inducement to him to devote his time, money, and talent to objects which, after a while, will become free to the world, and from which, in the meantime, the world has the opportunity of deriving benefit. For it must not be lost sight of that the advantages of an inventor and the public run together in any invention of real value; since the inventor will not sell unless he sees his way to remuneration, and the public will not buy unless there is some temptation to buy.

To rule that however much a man may have exerted himself mentally or physically to accomplish a given result, any and every one may step in and seize that result as soon as it is proved to be of value, seems to me the height of injustice. And as regards the public, I cannot but think that it is far more advantageous that inventors should be influenced by the motive for exertion, which a limited monopoly in their inventions affords, than that the inventive faculty should be checked by the knowledge that, be the intrinsic value of the discovery what it may, they must only go shares with the rest of the world. In the majority of cases this would be tantamount to depriving them of all reward.

VINDEX.

MECHANIC'S LIBRARY.

Arithmetic, Reading, and Writing, 8vo, 2s 6d, cloth. Floyd.
Arts and Sciences, English, Cycle of, vol. 8, 12s. Knight.
Bridges, Construction of Cast and Wrought-Iron, 2 v. folio, £6 16s 6d. Humber.
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Scotland, Geological Map of, with Notes, 5s. Murchison and Geikie.
Trades, Book of, 13th ed., 16mo, 3s 6d, cloth.

REVIEWS OF NEW BOOKS.

THE MECHANICS OF CONSTRUCTION; Including the Theories of the Strength of Materials, Roofs, Arches, and Suspension Bridges. By Stephen Fenwick, Fellow of the Royal Military Academy, Woolwich. London: Bell & Daldy, 186 Fleet Street. 1861. Pp. 228.

A BOOK that may be recommended to students for its clearness of exposition and for the number of examples. The best works published here or on the Continent have been consulted, and the author has produced a compendious volume, which may be profitably introduced into educational establishments. It is divided into two parts.

"The First Part (says Mr Fenwick) includes the theory and some of the applications of the strength and resistance of materials. The Second Part contains the theory and the construction of roofs and arches. The straining forces which act upon a structure having been determined by simple statical considerations, formulæ of solution are thence deduced with the ultimate view of estimating the strength of each particular construction. These formulæ are the result of exact mathematical reasoning. The various experimental data which have been adopted, are placed in convenient juxtaposition with each corresponding theoretical section. Throughout the whole work the method of determining the dimensions of the different parts of a structure, in order to fulfil certain conditions, has been attentively kept in view. This important feature constitutes a distinguishing characteristic of the present publication. In no other English work is this method adopted with respect to torsion, solids, or equal resistance, roofs and arches. It is a remarkable fact, noticed by all experimentalists on the strength of materials, that after a certain point has been reached, any addition of strain increases the dilatation of a body in a much higher proportion than before this limit is passed. This, it is conjectured, arises from the disunion of the particles of the body, whose joint action contributed to the whole effect. Hence I have taken the utmost care to cite from the best authorities the necessary constants for those limits, which are usually denominated coefficients of safety. In the remarks immediately preceding the chapters on roofs and arches, it is shown that a structure may yield and give way either by the sliding of certain of its surfaces of contact upon one another, or by their turning upon one another, and that the stability of the structure must be studied with reference to each of these suppositions. In the determination of the stability of the arch, it may be observed, the main elements of investigation are the horizontal thrust, the point of application of this thrust, and the weakest joint of the arch; and on this part of my work I have bestowed the utmost attention. The immense progress of railways in this country during years recently past, has greatly modified the theory and practice of bridge building. I have, in consequence, thought it proper to diverge considerably from the ordinary tract that has been pursued in the elementary works on this subject that have hitherto appeared. The London and Waterloo bridges in the metropolis, which rank among the finest structures of the elliptical arch, and Stephenson's "Hutcheson Bridge" at Glasgow, which is one of the best specimens of the segmental arch, together with many others, have supplied me with a variety of problems for illustration."

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION AT MANCHESTER, 1861.

THE proceedings of the Association were opened by a meeting of the Council, at the Town Hall, on the morning of the 4th ult. At this meeting the report of the Council was discussed, and agreed to. At the meeting of the general Committee, held in the mayor's parlour, the Report was read by Professor Phillips. The general meeting of the Association took place in the large room of the Town Hall in the evening. The magnificent hall was brilliantly decorated for the occasion. Lord Wrottesley delivered an address on his retiring from office, in the course of which he spoke in very high terms of the scientific services of Dr Fairbairn, the president elect. At the close of his Lordship's remarks, Dr Fairbairn took the chair, and read his address, of which the following is an abstract.

During the last century, the science of applied mechanics has made strides which astonish us by their magnitude; but even these, it may reasonably be hoped, are but the promise of future and more wonderful enlargements. I therefore propose to offer a sufficient history of these improvements, as an instance of the influence of scientific progress on the well-being of society. I shall take in review the three chief aids which engineering science has afforded to national progress—namely, canals, steam navigation, and railways; each of which has promoted an incalculable extension of the industrial resources of the country.

One hundred years ago the only means for the conveyance of inland merchandise were the packhorses and waggons on the then imperfect highways. It was reserved for Brindley, Smeaton, and others, to introduce a system of canals, which opened up facilities for an interchange of commodities at a cheap rate over almost every part of the country. The impetus given to industrial operations by this new system of conveyance induced capitalists to embark in trade, mining, and the extension of manufactures in almost every district. These improvements continued for a series of years, until the whole country was intersected by canals requisite to meet the demands of a greatly extended industry. But canals, however well adapted for the transport of minerals and merchandise, were less suited for the conveyance of passengers. The speed of the canal boats seldom exceeded from two and a half to three miles an hour; and, in addition to this, the projectors of canals sometimes sought to take an unfair advantage of the Act of Parliament which fixed the tariff at so much per ton per mile, by adopting circuitous routes, under the erroneous impression that mileage was a consideration of great importance in the success of such undertakings. It is in consequence of short-sighted views and imperfect legislation that we inherit the numerous curves and distortions of our canal system. These defects in construction rendered canals almost useless for the conveyance of passengers, and led to the improvement of the common roads and the system of stage coaches; so that, before the year 1830, the chief public highways of the country had attained a remarkable smoothness and perfection, and the lightness of our carriages, and the celerity with which they were driven, still excites the admiration of those who remember them. These days of an efficiently worked system, which tasked the power and speed of the horse to the utmost, have now been succeeded by changes more wonderful than any that previously occurred in the history of the human race. Scarcely had the canal system been fully developed when a new means of propulsion was adopted—namely, steam. I need not recount to you the enterprise, skill, and labour that have been exerted in connection with steam navigation. You have seen its results on every river and every sea; results we owe to the fruitful minds of Miller, Symington, Fulton, and Henry Bell, who were the pioneers in the great march of progress. Viewing the past, with a knowledge of the present, and a prospect of the future, it is difficult to estimate sufficiently the benefits that have been conferred by this application of mechanical science to the purposes of navigation. Power, speed, and certainty of action have been attained on the most gigantic scale. The celerity with which a modern steamer, with a thousand tons of merchandise and some hundreds of human beings on board, cleaves the water and pursues her course, far surpasses the most sanguine expectations of a quarter of a century ago, and indeed almost rivals the speed of the locomotive itself. Previous to 1812, our intercourse with foreign countries and with our colonial possessions depended entirely upon the state of the weather. It was only in favourable seasons that that a passage was open, and we had often to wait days, or even a week, before Dublin could be reached from Holyhead. Now, this distance of 63 miles is accomplished in all weathers in little more than three hours. The passage to America used to occupy six weeks or two months; now it is accomplished in eight or nine days. The passage round the Cape to India is reduced from nearly half a year to less than a third of that time, whilst that country may be reached by the overland route in less than a month. These are a few of the benefits derived from steam navigation, and, as it is yet far from perfect, we may reasonably calculate on still greater advantages in our intercourse with distant nations. I will not here enter upon the subject of the numerous improvements which have so rapidly advanced the progress of this important service. Suffice it to observe that the paddle-wheel system of propulsion has maintained its superiority over every other method yet adopted for the attainment of speed, as by it the best results are obtained with the least expenditure of power. In ships of war the screw is indispensable, on account of the security it affords to the engines and machinery, from their position in the hold below the water line, and because of the facility it offers in the use of sails when the screw is raised from its position in the well to a recess in the stern prepared for that purpose. It is also preferable in ships which require auxilliary power in calms and adverse winds, so as to expedite the voyage and effect a considerable saving upon the freight.

The public mind had scarcely recovered itself from the changes which steam navigation had caused, and the impulse it had given to commerce, when a new and even more gigantic power of locomotion was inaugurated. Less than a quarter of a century had elapsed since the first steamboats floated on the waters of the Hudson and the Clyde, when the achievements thence resulting were followed by the application of the same agency to the almost superhuman flight of the locomotive and its attendant train. I well remember the competition at Rainhill in 1830, and the incredulity everywhere evinced at the proposal to run locomotives at 20 miles an hour. Neither George Stephenson himself, nor anyone else, had at that time the most distant idea of the capabilities of the railway system. On the contrary, it was generally considered impossible to exceed 10 or 12 miles an hour; and our present high velocities, due to high-pressure steam and the tubular system of boilers, have surpassed the most sanguine expectations of engineers. The sagacity of George Stephenson at once seized upon the suggestion of Henry Booth, to employ tubular boilers; and that, united to the blast pipe, previously known, has been the means of effecting all the wonders we now witness in a system that has done more for the development of practical science and the civilization of man than any discovery since the days of Adam.

From a consideration of the changes which have been effected in the means for the interchange of commodities I pass on to examine the progress which has been made in their production. And as the steam engine has been the basis of all our modern manufacturing industry, I shall glance at the steps by which it has been perfected.

Passing over the somewhat mythical fame of the Marquis of Worcester, and the labours of Savery, Beighton, and Newcomen, we come at once to discuss the state of mechanical art at the time when James Watt brought his gigantic powers to the improvement of the steam engine. At that time the tools were of the rudest construction, nearly everything being done by hand, and, in consequence, wood was much more extensively employed than iron. Under these circumstances Watt invented separate condensation, rendered the engine double acting, and converted its rectilinear motion into a circular one suitable for the purposes of manufacture. But the discovery at first made little way, the public did not understand it, and a series of years elapsed before the difficulties, commercial and mechanical, which opposed its application, could be overcome. When the certainty of success had been demonstrated, Watt was harassed by infringements of his patent, and law-suits for the maintenance of his rights. Inventors and pretended inventors set up claims, and entered into combination with manufacturers, miners, and others, to destroy the patent and deprive him of the just fruits of his labour and genius. Such is the selfish heartlessness of mankind in dealing with discoveries not their own, but from which they expect to derive benefit. The steam engine, since it was introduced by Watt, has changed our habits in almost every condition of life. Things which were luxuries have become necessaries, and it has given to the poor man, in all countries in which it exists, a degree of comfort and independence, and a participation in intellectual culture unknown before its introduction. It has increased our manufactures tenfold, and has lessened the barriers which time and space interpose. It ploughs the land, and winnows and grinds the corn. It spins and weaves our textile fabrics. In mining, it pumps, winds, and crushes the ores. It performs those things with powers so great and so energetic as to astonish us at their immensity, whilst they are at the same time perfectly docile, and completely under human control. In war it furnishes the means of aggression, as in peace it affords the bonds of conciliation; and, in fact, places within reach a power which, properly applied, produces harmony and good-will among men, and leads to the happiest results in every condition of human existence. We may, therefore, well be proud of the honour conferred on this country as the cradle of its origin, and as having fostered its development from its earliest applications to its present high state of perfection. I cannot conclude this notice of the steam engine without observing the changes it is destined to effect in the cultivation of the soil. It is but a short time since it was thought inapplicable to agricultural purposes, from its great weight and expense. But more recent experience has proved this to be a mistake, and already in most districts we find that it has been pressed into the service of the farm. The small locomotive, mounted on a frame with four wheels, travels from village to village with its attendant, the threshing machine, performing the operations of threshing, winnowing, and cleaning, at less than one-half the cost by the old and tedious process of hand labour. Its application to ploughing and tillage on a large scale is, in my opinion, still in its infancy, and I doubt not that many members of this association will live to see the steam plough in operation over the whole length and breadth of the land. Much has to be done before this important change can be successfully accomplished; but with the aid of the agriculturist preparing the land so as to meet the requirements of steam machinery, we may reasonably look forward to a new era in the cultivation of the soil.

The extraordinary developments of practical science in our system of textile manufacture are, however, not entirely due to the steam engine, although they are now in a great measure dependent on it. The machinery of these manufactures had its origin before the steam engine had been applied, except for mining purposes; and the inventions of Arkwright, Hargreaves, and Crompton, were not conceived under the impression that steam would be their moving power. On the contrary, they depended upon water; and the cotton machinery of this district had attained considerable perfection before steam came to the aid of the manufacturer, and ultimately enabled him to increase the production to its present enormous extent. I shall not attempt a description of the machinery of the textile manufactures, because ocular inspection will be far more acceptable. I can only refer you to a list of establishments in which you may examine operations on a large scale, and which I earnestly recommend to your attention. I may, however, advert to a few of the improvements which have marked the progress of the manufacturing system in this country. When Arkwright patented his water frames in 1767, the annual consumption of cotton was about four million pounds weight. Now it is one thousand two hundred million pounds weight—three hundred times as much. Within half a century the number of spindles at work, spinning cotton alone, has increased tenfold; whilst, by superior mechanism, each spindle produces fifty per cent. more yarn than on the old system. Hence the importance to which the cotton trade has risen, equalling at the present time the whole revenue of the three kingdoms, or £70,000,000 sterling per annum. As late as 1820 the power loom was not in existence; now it produces about fourteen million yards of cloth, or, in more familiar terms, nearly eight thousand miles of cloth per diem. I give these particulars to show the immense power of production of this country, and to afford some conception of the number and quality of the machines which effect such wonderful results. Mule spinning was introduced by Crompton, in 1787, with about twenty spindles to each machine. The powers of the machine were, however, rapidly increased; and now it has been so perfected that 2000 or even 3000 spindles are directed by a single person. At first the winding on, or forming the shape of the cop, was performed by hand; but this has been superseded by rendering the machine automatic, so that it now performs the whole operation of drawing, stretching, and twisting the thread, and winding it on the exact form, ready for the reel or the shuttle as may be required. These, and other improvements in carding, roving, combining, spinning and weaving, have established in this country an entirely new system of industry; it has given employment to greatly increased numbers, and a more intelligent class of workpeople.

Similarly important improvements have been applied to the machinery employed in the manufacture of silk, flax, and wool; and we have only to watch the processes in these different departments to be convinced that they owe much to the development of the cotton manufacture. In the manufacture of worsted, the spinning-jenny was not employed at Bradford until 1790, nor the power-loom until about 1825. The production of fancy or mixed goods from alpaca and mohair wool, introduced to this country in 1836, is perhaps the most striking example of a new creation in the art of manufacture, and is chiefly due to Mr Titus Salt, in whose immense palace of industry, at Saltaire, it may be seen in the greatest perfection. In flax machinery, the late Sir Peter Fairbairn was one of the most successful inventors, and his improvements have contributed to the rapid extension of this manufacture.

I might greatly extend this description of our manufacturing industry, but I must for the present be brief, in order to point out the dependence of all these improvements on the iron and coal so widely distributed amongst the mineral treasures of our island. We are highly favoured in the abundance of these minerals, deposited with an unsparing hand by the great Author of Nature under so slight a covering as to bring them within the reach of the miner's art. To them we owe our present high state of perfection in the useful arts; and to their extended application we may safely attribute our national progress and wealth. So that, looking to the many blessings which we daily and hourly receive from these sources alone, we are impressed with devotional feelings of gratitude to the Almighty for the manifold bounties he has bestowed upon us.

Previously to the inventions of Henry Cort, the manufacture of wrought iron was of the most crude and primitive description. A hearth and a pair of bellows was all that was employed. But, since the introduction of puddling, the iron-masters have increased the production to an extraordinary extent, down to the present time, when processes for the direct conversion of wrought iron on a large scale are being attempted. A consecutive series of chemical researches into the different processes, from the calcining of the ore to the production of the bar, carried on by Dr Percy and others, has led to a revolution in the manufacture of iron; and although it is at the present moment in a state of transition, it nevertheless requires no very great discernment to perceive that steel and iron of any required tenacity will be made in the same furnace, with a facility and certainty never before attained. This has been effected, to some extent, by improvements in puddling; but the process of Mr Bessemer—first made known at the meetings of this Association at Cheltenham—affords the highest promise of certainty and perfection in the operations of converting the melted pig direct into steel or iron, and is likely to lead to the most important developments in this manufacture. These improvements in the production of the material must, in their turn, stimulate its application on a larger scale and add to new constructions.

In iron-ship building, an immense field is open before us. Our wooden walls have, to all appearance, seen their last days; and, as one of the early pioneers in iron construction, as applied to ship-building, I am highly gratified to witness a change of opinion that augurs well for the security of the liberties of the country. From the commencement of iron ship building in 1830 to the present time, there could be only one opinion amongst those best acquainted with the subject, namely, that iron must eventually supersede timber in every form of naval construction. The large ocean steamers, the Hamalaya, the Persia, and the Great Eastern, abundantly show what can be done with iron, and we have only to look at the new system of casing ships with armour plates, to be convinced that we can no longer build wooden vessels of war with safety to our naval superiority and the best interests of the country. I give no opinion as to the details of the reconstruction of the navy,—that is reserved for another place,—but I may state that I am fully persuaded that the whole of our ships of war must be re-built of iron, and defended with iron armour calculated to resist projectiles of the heaviest description at high velocities. In the early stages of iron-ship building, I believe I was the first to show, by a long series of experiments, the superiority of wrought iron over every other description of material in security and strength, when judiciously applied in the construction of ships of every class. Other considerations, however, affect the question of vessels of war; and although numerous experiments were made, yet none of the targets were on a scale sufficient to resist more than a six-pounder shot. It was reserved for our scientific neighbours, the French, to introduce thick iron plates as a defensive armour for ships. The success which has attended the adoption of this new system of defence affords the prospect of invulnerable ships of war, and hence the desire of the Government to re-model the navy on an entirely new principle of construction, in order that we may retain its superiority as the great bulwarks of the nation. A Committee has been appointed by the War Office and the Admiralty for the purpose of carrying out a scientific investigation of the subject, so as to determine—first, the best description of material to resist projectiles; secondly, the best method of fastening and applying that material to the sides of ships and land fortifications; and lastly, the thickness necessary to resist the different descriptions of ordnance. It is asserted, probably with truth, that whatever thickness of plates are adopted for casing ships, guns will be constructed capable of destroying them. But their destruction will even then be a work of time, and I believe, from what I have seen in recent experiments, that with proper armour it will require not only the most powerful ordnance, but also a great concentration of fire, before fracture will ensue. If this be the case, a well-constructed iron ship, covered with sound plates of the proper thickness, firmly attached to its sides, will, for a considerable time, resist the heaviest guns which can be brought to bear against it, and be practically shot proof. But our present means are inadequate for the production of large masses of iron, and we may trust that, with new tools and machinery, and the skill, energy, and perseverance of our manufacturers, every difficulty will be overcome, and armour plates produced which will resist the heaviest existing ordnance.

The rifling of heavy ordnance, the introduction of wrought iron, and the new principle of construction with strained hoops, have given to all countries the means of increasing enormously the destructive power of their ordnance. One of the results of this introduction of wrought iron, and correct principles of manufacture, is the reduction of the weight of the new guns to about two-thirds the weight of the older cast-iron ordnance. Hence follows the facility with which guns of much greater power can be worked, whilst the range and precision of fire are at the same time increased. But these improvements cannot be confined to ourselves. Other nations are increasing the power and range of their artillery in a similar degree, and the energies of the nation must, therefore, be directed to maintain the superiority of our navy in armour as well as in armament.

We have already seen a new era in the history of the construction of bridges, resulting from the use of iron; and we have only to examine those of the tubular form over the Conway and Menai Straits to be convinced of the durability, strength, and lightness of tubular constructions applied to the support of railways or common roads in spans which, ten years ago, were considered beyond the reach of human skill. When it is considered that stone bridges do not exceed 150 feet in span, nor cast-iron bridges 250 feet, we can estimate the progress which has been made in crossing rivers 400 or 500 feet in width, without any support at the middle of the stream. Even spans, greatly in excess of this, may be bridged over with safety, provided we do not exceed 1800 to 2000 feet, when the structure would be destroyed by its own weight.

It is to the exactitude and accuracy of our machine tools that our machinery of the present time owes its smoothness of motion and certainty of action. When I first entered this city, the whole of the machinery was executed by hand. There were neither planing, slotting, nor shaping machines; and, with the exception of very imperfect lathes and a few drills, the preparatory operations of construction were effected entirely by the hands of the workmen. Now everything is done by machine tools, with a degree of accuracy which the unaided hand could never accomplish. The automaton, or self-acting machine tool, has within itself almost a creative power; in fact, so great are its powers of adaptation that there is no operation of the human hand that it does not imitate. For many of these improvements the country is indebted to the genius of our townsmen, Mr Richard Roberts and Mr Joseph Whitworth. The importance of these constructive machines is, moreover strikingly exemplified in the Government works at Woolwich and Enfield Lock, chiefly arranged under the direction of Mr Anderson, the present inspector of machinery, to whose skill and ingenuity the country is greatly indebted for the efficient state of those great arsenals.

Amongst the changes which have largely contributed to the comfort and enjoyment of life, are the improvements in the sanitary condition of towns. These belong, probably, to the province of social rather than mechanical science; but I cannot omit to notice some of the great works that have of late years been constructed for the supply of water, and for the drainage of towns. In former days, 10 gallons of water to each person per day was considered an ample allowance. Now 30 gallons is much nearer the rate of consumption. I may instance the waterworks of this city and of Liverpool, each of which yield a supply of from 20 to 30 gallons of water to each inhabitant. In the former case the water is collected from the Cheshire and Derbyshire hills, and, after being conveyed in tunnels and aqueducts a distance of ten miles to a reservoir, where it is strained and purified, it is ultimately taken a farther distance of eight miles in pipes, in a perfectly pure state, ready for distribution. The greatest undertaking of this kind, however, yet accomplished, is that by which the pure waters of Loch Katrine are distributed to the city of Glasgow. This work, recently completed by Mr Bateman, who was also the constructor of the waterworks of this city, is of the most gigantic character, the water being conveyed in a covered tunnel a distance of 27 miles, through an almost impassable country, to the service reservoir, about eight miles from Glasgow. By this means, 40,000,000 gallons of water per day are conveyed through the hills which flank Ben Lomond, and after traversing the sides of Loch Chon and Loch Aird, are finally discharged into the Mugdoch basin, where the water is impounded for distribution. We may reasonably look forward to an extension of similar benefits to the metropolis, by the same engineer, whose energies are now directed to an examination of the pure fountains of Wales, from whence the future supply of water to the great city is likely to be derived. A work of so gigantic a character may be looked upon as problematical; but when it is known that six or seven millions of money would be sufficient for its execution, I can see no reason why an undertaking of so much consequence to the health of London should not ultimately be accomplished.

A brief allusion must be made to that marvellous discovery which has given to the present generation the power to turn the spark of heaven to the uses of speech; to transmit along the slender wire for 1000 miles a current of electricity that renders intelligible words and thoughts. This wonderful discovery, so familiar to us, and so useful in our communications to every part of the globe, we owe to Wheatstone, Thomson De la Rive, and others. In land telegraphy the chief difficulties have been surmounted, but in submarine telegraphy much remains to be accomplished. Failures have been repeated so often as to call for a Commission on the part of the Government to inquire into the causes, and the best means of overcoming the difficulties which present themselves. I had the honour to serve on that Commission; and I believe that from the report, and mass of evidence and experimental research accumulated, the public will derive very important information. It is well known that three conditions are essential to success in the construction of ocean telegraphs—perfect insulation, external protection, and appropriate apparatus for laying the cable safely on its ocean bed. That we are far from having succeeded in fulfilling these conditions is evident from the fact that out of twelve thousand miles of submarine cable which have been laid since 1851, only three thousand miles are actually in working order; so that three-fourths may be considered as a failure and loss to the country. The insulators hitherto employed are subject to deterioration from mechanical violence, from chemical decomposition or decay, and from the absorption of water; but the last circumstance does not appear to influence seriously the durability of cables. Electrically, india rubber possesses high advantages, and, next to it, Wray's compound and pure gutta percha far surpass the commercial gutta percha hitherto employed; but it remains to be seen whether the mechanical and commercial difficulties in the employment of these new materials can be successfully overcome. The external protecting covering is still a subject of anxious consideration. The objections to iron wire are its weight and liability to corrosion. Hemp has been substituted, but at present with no satisfactory result. All these difficulties, together with those connected with the coiling and paying out of the cable, will no doubt yield to careful experiment and the employment of proper instruments in its construction and its final deposit on the bed of the ocean. Irrespective of inland and international telegraphy, a new system of communication has been introduced by Professor Wheatstone, whereby intercourse can be carried on between private families, public offices, and the works of merchants and manufacturers. This application of electric currents cannot be too highly appreciated, from its great efficiency and comparatively small expense. To show to what an extent this improvement has been carried, I may state that one thousand wires, in a perfect state of insulation, may be formed into a rope not exceeding half an inch in diameter. I must not sit down without directing attention to a subject of deep importance to all classes—namely, the amount of protection inventors should receive from the laws of the country. It is the opinion of many that patent laws are injurious rather than beneficial, and that no legal protection of this kind ought to be granted; in fact, that a free trade in inventions, as in everything else, should be established. I confess I am not of that opinion. Doubtless there are abuses in the working of the patent law as it at present exists, and protection is often granted to pirates and impostors, to the detriment of real inventors. This, however, does not contravene the principle of protection, but rather calls for reform and amendment. It is asserted by those who have done the least to benefit their country by inventions, that a monopoly is injurious, and that if the patent laws are defended, it should be, not on the ground of their benefit to the inventor, but on that of their utility to the nation. I believe this to be a dangerous doctrine, and I hope it will never be acted upon. I cannot see the right of the nation to appropriate the labours of a lifetime, without awarding any remuneration. The nation, in this case, receives a benefit; and assuredly the labourer is worthy of his hire. I am no friend of monopoly, but neither am I a friend of injustice; and I think that before the public are benefited by an invention, the inventor should be rewarded either by a fourteen years' monopoly, or in some other way. Our patent laws are defective, so far as they protect pretended inventions; but they are essential to the best interests of the state in stimulating the exertions of a class of eminent men, such as Arkwright, Watt, and Crompton, whose inventions have done honour to the human race. To this Association is committed the task of correcting the abuses of the present system, and establishing such legal provisions as shall deal out equal justice to the inventor and the nation at large. I must not forget that we owe very much to an entirely new and most attractive method of diffusing knowledge, admirably exemplified in the Great Exhibition of 1851, and its successors in France, Ireland, and America. Most of us remember the gems of art which were accumulated in this city during the summer of 1857, and the wonderful results they produced on all classes of the community. The improvement of taste, and the increase of practical knowledge which followed these Exhibitions, has been deeply felt; and hence the prospects which are now opening before us in regard to the Exhibition of the next year cannot be too highly appreciated. That Exhibition will embrace the whole circle of the sciences, and is likely to elevate the general culture of the public to a higher standard than we have ever before attained. There will be unfolded almost every known production of art, every ingenious contrivance in machinery, and the results of discoveries in science from the earliest period. The fine arts, which constituted no part of the Exhibition of 1851, and which were only partially represented at Paris and Dublin, will be illustrated by new creations from the most distinguished masters of the modern school. Looking forward, I venture to hope for a great success and a further development of the principle advocated by this Association—the union of science and art.

At a Meeting of the General Committee in the Mayor's parlour, Prof. PHILLIPS read the —

Report of the Council.

1. The Council were directed by the General Committee at Oxford to maintain the establishment of the Kew Observatory by aid of a grant of £500. At each of the meetings of the Council the Committee of the Observatory have presented a detailed statement of their proceedings, and they have transmitted the General Report for the year 1860-1861, which is annexed.

2. A sum not exceeding £90 was granted for one year and placed at the disposal of the Council, for the payment of an additional photographer for carrying on the photoheliographical observations at Kew. On this subject the Report of the Kew Committee may be consulted.

3. A further sum of £30 was placed at the disposal of Mr Broun, Dr Lloyd, and Mr Stoney, for the construction of an induction dip-circle in connection with the Observatory at Kew. The result of this recommendation is stated in the Report of the Kew Committee.

4. The Report of the Parliamentary Committee has been received by the Council for presentation to the General Committee to-day, and is printed for the information of the members.

5. Prof. Phillips was requested to complete and place before the Manchester Meeting, a Classified Index to the *Transactions* of the Association from 1831 to 1860 inclusive, and was authorized to employ during this period an assistant; and the sum of £100 was placed at his disposal for the purpose. Prof. Phillips reports that he has secured the assistance of Mr. G. Griffith, of Jesus College, Oxford, in carrying on the index, which had been already much advanced by the help of Mr Askham, and states that with the aid thus afforded he had hoped to be able to complete the work within the time specified. Though this expectation has not been realized, specimens of the work are laid before the Meeting.

6. Prof. Phillips requested the attention of the Council to circumstances regarding his own health and occupations, which are gradually rendering it necessary for him to prepare to withdraw from the duties of the Assistant General Secretary, which have been for many years intrusted to him, and suggested that opportunity might be taken of this announcement to consider whether the arrangements connected with the secretariate should remain unchanged, or be modified. The Council regret to have received letters from Prof. Walker, General Secretary, dated the 15th of March and 20th of April, stating that, on account of indisposition which require cessation from labour, it would not be in his power to continue his attention to the official business of the Association. Under those circumstances the Council requested Prof. Phillips to draw up in writing such statements and suggestions as might appear to him likely to assist the Council in considering the steps to be taken in consequence of these announcements. The statement drawn up by Prof. Phillips, in consequence of this request, is printed for the information of the Members.

7. The communication of Prof. Phillips in reference to the appointment of a General Secretary having been considered, the following resolution was adopted: —"That the President and the gentlemen who have formerly acted as General Secretaries—viz., the Rev. W. V. Harcourt, Sir R. I. Murchison, and Major-General Sabine, together with Prof. Phillips, be a committee to consider and report the steps which they deem it advisable for the Council to take in regard to the appointment of a General Secretary; and that their Report be printed and circulated among the Members of Council previous to their Meeting in Manchester on the 4th of September next."

By the following Report, which has been received from these gentlemen, the General Committee will learn with satisfaction that if it be their pleasure to elect him, the services of a most efficient and experienced Member, who has discharged many offices, including the Presidency, with great benefit to the Association, are at their disposal for the duty of General Secretary:—

"*Report of the Rev. W. V. Harcourt, Sir R. I. Murchison, and Major-General Sabine,*

"Considering the present state of health of the General Secretary of the British Association, the Rev. Prof. Walker, F.R.S., and the announced withdrawal at no distant period of Prof. John Phillips, F.R.S., from the post of Assistant General Secretary, which he has so long held, and with such very great advantage to the British Association, we, the undersigned, as requested by the Council to propose some suitable arrangement, have now to express our unanimous opinion that Mr William Hopkins, F.R.S., of St. Peter's College, Cambridge, is eminently qualified to fill the post of Joint General Secretary. We beg to add that, having applied to Mr Hopkins, we find that he cordially accepts the offer, and, with the sanction of the Council, will be ready to commence his duties at the ensuing Manchester Meeting. The consideration of the future relation of Prof. Phillips to the British Association is postponed, in compliance with his own request.

"WILLIAM VERNON HARCOURT, RODERICK I. MURCHISON, EDWARD SABINE,
Former General Secretaries.
"July 25, 18 1."

The Council have resolved, in conformity with the recommendation of this Report, to propose to-day in the General Committee that W. Hopkins, Esq., M.A., F.R.S., be elected General Secretary.

8. The following foreign gentlemen, eminent in science, who were present at the late Oxford Meeting, and took part in the proceedings were elected Corresponding Members of the British Association:—Dr Bergsma, Utrecht; Dr Carus, Leipzig; Prof. A. Favre, Geneva; Dr Geinitz, Dresden; Dr Hochstetter, Vienna; M. Khanikoff, St Petersburg; M. Werner Siemens, Vienna; Prof. B. Pierce, Cambridge, United States; Prof. E. Verdet, Paris.

9. Major-General Sabine communicated a copy of the Statutes of the Humboldt Foundation, now definitely organized, and of a circular issued by the Committee announcing that about £8,000 had been secured as a capital fund, and that about £260 will be available in the year 1862 for the general object of assisting researches in Natural Science and Travels in which Humboldt was conspicuously active. The disposition of the fund rests with the Royal Academy of Sciences of Berlin, and is open to applications from scientific travellers of all nations.

10. The Council are informed that invitations will be presented to the General Committee at its Meeting, on Monday, September 9, to hold the next Meeting in Cambridge. The invitations formerly offered on the part of Birmingham and Newcastle-on-Tyne will be renewed on this occasion; and other invitations will be presented from Bath and Nottingham.

Prof. PHILLIPS read a letter from Prof. Walker, containing his resignation. The resignation was accepted, and Mr. Hopkins elected to the vacant office.

Mr NINNIS read the financial statement:—

The General Treasurer's Account,

From June 27, 1860 (at Oxford), to September 2, 1861 (at Manchester).

RECEIPTS.	£.	s.	d
To Balance from last Account	718	17	8
Life Compositions at Oxford and since	250	0	0
Annual Subscriptions ditto ditto	399	0	0
Associates' Tickets ditto ditto	636	0	0
Ladies' ditto ditto ditto	463	0	0
Dividends on Stock, Eighteen Months	295	2	6
Glasgow Local Fund, Balance of Account, per Executors of the late William Gourlie	2	1	8
Sale of Publications—viz., Reports of Meetings, Catalogues of Stars, &c.	140	13	2
	£2,905	0	0

PAYMENTS.		£.	s.	d
By paid expenses of Oxford Meeting, sundry Printing, &c.		871	19	9
Account of Report of 29th Meeting		293	11	8
Ditto ditto 30th ditto		65	19	6
Salaries, Twelve Months'		350	0	0
Purchase of Stock, £500 3 per cent. Consols		467	10	0
Maintaining Establishment at Kew Observatory		500	0	0
Earthquake Experiments		25	0	0
Dredging on East Coast of Scotland		23	0	0
Dredging Committee 1859-60		72	0	0
Dura Den Yellow Sandstone		20	0	0
Solubility of Salts		20	0	0
Steam-Vessel Performances		150	0	0
Fossils of Lesmahagow		15	0	0
Exploring Uriconium		20	0	0
Chemical Alloys		20		0
Classified Index of Transactions		100	0	0
Dredging in Mersey and Dee		5	0	0
Dip Circle		30	0	0
Photoheliographic Observations		50	0	0
Experiments on the Constituents of Manures		25	0	0
Prison Diet upon the Bodily Functions of Prisoners		20	0	0
Gauging of Water		10	0	0
Alpine Ascents		6	5	10
Balance at the Bankers	£227 8 10			
Ditto in hand of the General Treasurer and Local Treasurers	17 4 5			
		241	13	3
		£2,905	0	0

Mr. Ninnis also stated that the Assets of the Association consisted of—

	£	s.	d.
Balance Cash	£241	13	3
Value of Stock unsold	6,510	0	0
Value of Books on hand, at half price, about	2,000	0	0
	£8,754	13	3

Mr. GASSIOT presented the

Report of the Kew Committee.

The Committee of the Kew Observatory beg to submit to the Association the following Report of their proceedings during the past year.

It was noticed in a previous Report that General Sabine had undertaken to tabulate the hourly values of the magnetic elements from the curves given by these instruments. These values have been reduced under his superintendence, and some of the results have been embodied in the following papers which he has communicated to the Royal Society.

1. On the Solar-diurnal Variation of the Magnetic Declination at Pekin—Proceedings of the Royal Society, vol. x., p. 360. 2. On the Laws of the Phenomena of the larger Disturbances of the Magnetic Declination in the Kew Observatory: with notices of the progress of our knowledge regarding the Magnetic Storms.—Proceedings of the Royal Society, vol. x, p. 624. 3. On the Lunar-diurnal Variation of the Magnetic Declination obtained from the Kew Photograms in the years 1858, 1859 and 1860.—Proceedings of the Royal Society, vol. xi., p. 73.

The Superintendent, Mr Stewart, has also communicated to the Royal Society a description of the great magnetic storm at the end of August and beginning of September 1859, deduced from the Kew Photographs.

Mr Chambers continues to be zealously employed in the magnetical department, and attends to the self-recording magnetographs, which have been maintained in constant operation.

The usual monthly absolute determinations of the magnetic elements continue to be made, and the dip observations from November 1857 to the present date (282 in all), a large portion of which were made by the late Mr Welsh and Mr Chambers, have been made available by General Sabine in connexion with some previous observations of his own for determining the secular change in the magnetic dip in London, between the years 1821 and 1860.—See Proceedings of the Royal Society, vol. xi., p. 144.

The instruments for the Dutch Government alluded to in the last Report have been verified at Kew and taken away. They consisted of a set of self-recording magnetographs with a tabulating instrument, two dip circles, and one Fox's dip circle for Dr Bergsma; also of two unifilars, one for Dr Bergsma and one for Dr Buys Ballot.

Shortly after the despatch of these instruments, another set of self-recording magnetographs were received at Kew, in order to be tested previous to their being sent to Dr Bache, of the United States, and these were despatched in the early part of this year to America, along with a tabulating instrument, a unifilar, and dip-circle, all of which were verified at Kew.

The staff at Kew are at present occupied with a third set of these instruments, along with a dip-circle and unifilar, for the University of Coimbra; and Prof. Da Souza of that University is engaged at present at the Kew Observatory in examining his instruments, and in receiving instructions regarding them.

It will thus be seen that no fewer that three sets of these instruments have been furnished during this last year, under the superintendence of the Committee, and it has hitherto been deemed advisable for the interests of science that no charge should be made for their verification. As this, however, is an operation involving labour and a large expenditure of time, an application was made to the Royal Society for the sum of £90 from the Donation Fund, in order to cover the expense of verifying these three sets of instruments, while it was arranged that in future a charge of £30 for verification should be added to the cost of each set. This sum was at once granted by the Council of the Royal Society, and it will be found among the receipts in the financial statement appended to this Report.

In addition to the instruments already mentioned, the following have also been verified at Kew Observatory:—For the Havana Observatory, a set of differential magnetic instruments, also a unifilar, dip-circle, and an altitude and azimuth instrument for absolute determinations of the magnetic elements. For Dr Smallwood, Montreal, a unifilar, dip-circle, and differential declinometer. For the Astronomer Royal, Greenwich, a 9-inch unifilar. For the Rev. W. Scott, Sydney, a unifilar and dip-circle. For Dr Livingstone, Africa, a unifilar, dip-circle and azimuth compass. For Mr Jackson, Bach. of Science, Ceylon, a unifilar and dip-circle.

Mr Jackson and M. Capello, of the Lisbon Observatory, have also received instruction at Kew in the use of instruments.

The meteorological work of the Observatory continues to be performed in a satisfactory manner by Mr George Whipple; and here the Committee desire to mention that both from the report of the Superintendent, and from their own observation, each member of the staff at present attached to the establishment seems to interest himself in the duties he is called upon to discharge.

During the past year, 150 barometers, 660 thermometers and 8 hydrometers have been verified at the Observatory. Seven standard thermometers have also been constructed and disposed of. Dr Bergsma and Dr Buys Ballot were each presented with one of these instruments.

For some time telegraphic reports of the meteorological elements were daily sent to Admiral FitzRoy's office, the expense being defrayed by the Board of Trade; but these despatches were ultimately discontinued, on account of the Board of Trade having only a limited sum disposable for meteorological telegraphy, and Kew being too near London to prove a useful station.

At the last meeting at Oxford it was announced that the Kew Heliograph was about to be transported to Spain for the purpose of photographing, if possible, the so-called red flames visible on the occasion of a total solar eclipse. That the mission had most successfully accomplished the object contemplated was known in England on the morning of the 19th of July, 1860 (the day after the eclipse), by the publication in the *Times* newspaper of a telegram sent by Mr Warren De la Rue from Rivabellosa, near Miranda, where the Kew party were stationed.

It will be remembered that, at the suggestion of the Astronomer Royal, the Admiralty had placed at the disposal of the expedition of astronomers H.M. ship Himalaya, and that the Government Grant Committee of the Royal Society had voted the sum of £150 for the purpose of defraying the expenses of transporting the Kew Heliograph with a staff of assistants to Spain. As the scheme became matured, it was deemed desirable to extend considerably the preparations originally contemplated, and actual experience subsequently proved that no provision which had been made could have been safely omitted. Originally it was thought that a mere temporary tent for developing the photographs, might have answered the purpose; but on maturing the scheme of operations, it became evident that a complete photographic Observatory, with its dark developing room, cistern of water sink, and shelves to hold the photographs, would be absolutely necessary to ensure success. An Observatory was therefore constructed in such a manner that it could be taken to pieces and made into packages of small weight for easy transport, and at the same time be readily put together again on the locality selected. The house when completed weighed 1248lb., and was made up in eight cases. Altogether the packages, including house and apparatus, amounted in number to thirty, and in weight to 34 cwt. Besides the Heliograph, the apparatus comprised a small transit theodolite for determining the position of the meridian, and ascertaining local time, and the latitude and longitude of the station, and also a very fine three-inch achromatic telescope, by Dallmeyer, for the optical observation of the phenomena of the eclipse. Complete sets of chemicals were packed in duplicate in separate boxes, to guard against failure through a possible accident to one set of the chemicals. Collodion of different qualities was made sensitive in London, and some was taken not rendered sensitive, so as to secure as far as possible good results. Distilled water, weighing 1391lb., had to be included; and engineers' and carpenters' tool, weighing 1131lb., were taken. Mr Casella lent some thermometers and a barometer, and Messrs Elliott an aneroid barometer to the expedition.

The preparations were commenced by Mr Beckley (of the Kew Observatory) early in the year 1860; and in June Mr De La Rue engaged Mr Reynolds to assist Mr Beckley in completing them. Mr Beckley and Mr Reynolds were charged with the erection of the Observatory at Rivabellosa: and so well were the plans organised that the Observatory and Heliograph were in actual operation on the 12th of July, the expedition having sailed from Plymouth in the Himalaya on the morning of the 7th. This could not, however, have been so expeditiously accomplished without the energetic co-operation of Mr Vignoles, who met the Himalaya in a small steamer he had chartered to convey the expedition and their apparatus into the port of Bilbao, and who despatched the Kew apparatus as soon as it was landed to the locality he and Mr De La Rue had agreed upon. This was situated seventy miles distant from the port of landing, and accessible only through a difficult pass. Mr Vignoles had also taken the trouble to make arrangements for accommodating the Kew party, and for the due supply of provisions—a matter of some importance in such a locality.

Besides Mr De La Rue, Mr Beckley and Mr Reynolds, the party consisted of Mr Downes and Mr E. Beck, two gentlemen who gave their gratuitous services, and of Mr Clark who acted as interpreter, also kindly assisting during the eclipse. Each of the party had only one thing to attend to, and thus rapidity of operation and certainty of result were secured. The total expenditure of this expedition amounted to £512; the balance of £362 over the amount granted by the Royal Society has been generously defrayed by Mr De La Rue.

Upwards of forty photographs were taken during the eclipse and a little before and after it, two being taken during the totality, on which are depicted the luminous prominences with a precision impossible of attainment by hand drawings. The measurements which have been made of these prominences by Mr De La Rue show incontrovertibly that they must belong to the sun, and that they are not produced by the deflection of the sun's light through the valleys of the moon. The same prominences, except those covered during the moon's progress, correspond exactly when one negative is laid over the other; and by copying these by means of a camera, when so placed, a representation is obtained of the whole of the prominences visible during the eclipse in their true relative position. The photographs of the several phases of the eclipse have served to trace out the path of the moon's centre in reference to the sun's centre during the progress of the phenomenon. Now, Rivabellosa being north of the central line of the moon's shadow, the moon's centre did not pass exactly across the sun's centre, but was depressed a little below it so that a little more of the prominences situated on the north (the upper) limb of the sun became visible than would have been the case exactly under the central line, while, on the other hand, a little of those on the southern limb was shut off. It has been proved by measuring the photographs, that the moon during the totality covered and uncovered the prominences to the extent of about 94" of arc in the direction of her path, and that a prominence situated at a right angle to the path shifted its angular position with respect to the moon's centre by lagging behind 5° 55'. On both the photographs is recorded a prominence, not visible optically, showing that photograpy can render visible phenomena, which without its aid would escape observation. Copies of the two totality pictures are being made to illustrate Mr De La Rue's paper in the Report of the Himalaya Expedition by the Astronomer Royal. Positive enlarged copies of the phases of the eclipse 9 inches in diameter, have also been made by means of the camera, and will be exhibited at the Manchester Meeting

The Heliograph has since been replaced in the Observatory, but few opportunities have occurred for using it in consequence of the pressure of other work; latterly however, Mr Beckley has been requested to carry on some experiments with the view of ascertaining whether any more details are rendered visible when the ful aperture of 3 inches of the telescope is used, than when it is reduced to about one inch and a half. Up to the present time no definite conclusion can be drawn from the results obtained: so that, at all events, an increase of aperture does not appear to give a strikingly better result when a picture of the same size is taken with various apertures of the object-glass. More experiments, however, are needed before this point, which is one of some importance in guiding us in the construction of future instruments, can be answered definitely. Mr Beckley has obtained sun pictures of great beauty during the course of these experiments.

The work of the Kew Observatory is now so increased that it has become absolutely imperative to make some provision for working the Heliograph in a way that will not interfere with the current work of that establishment; and Mr De La Rue has been requested by his colleagues of the Kew Committee to take charge of the instrument at his observatory, where celestial photography is continuously carried on. This request Mr De La Rue has kindly acceded to; and he will for a time undertake to record the sun spots at Cranford, as long as it is found not to interfere with his other observations. Mr De La Rue has contrived, and had made by Messrs Simms, at his own expense, an instrument for measuring the photographs, which will much facilitate the reduction of the results. It consists of a fixed frame in which work two slides, moving at right angles to each other. Each is furnished with a vernier reading to $\frac{1}{1000}$th of an inch. The top slide works on the lower slide, and carries a hollow axis 4½ inches diameter, on which rotates horizontally a divided circle reading to 10″, and this carries a second circle on the face of which are fixed four centring screws. An image intended to be measured is placed on the upper circle, and is centred by means of the adjusting screws; it is then adjusted by means of the upper circle in any required angular position with respect to the lower divided circle, so as to bring the cross lines of the photograph in position under a fixed microscope, supported on an arm from the fixed frame. By means of this instrument the sun pictures are measured so as to determine the diameter to $\frac{1}{2000}$th of the radius; the angular position of any part of a sun spot and its distance from the centre are thus readily ascertained, or the differences of the right ascension and declination with respect to the centre are as easily read off to the same degree of accuracy.

Mr De La Rue has recently produced by his large telescope an image of a solar spot, and portion of the sun's disc, far superior to anything before effected, and which leads to the hope that a new era is opened in heliography, and that the resources of this Observatory might be further developed in that direction.

At the last Meeting of the Association the sum of £90 was voted for an additional photographer, and of this sum £50 has been received. The Committee suggest that the balance of £40 be granted again at this meeting, as the full sum will be required during the ensuing year. A detailed account of this expenditure will be presented in the next Annual Report.

Allusion was made in last Report to an instrument constructed by Prof. William Thomson, of Glasgow, for determining photographically the electric state of the atmosphere. This instrument has been fitted up at Kew, where it has been in constant operation since the beginning of February last. It has been found to answer well in a photographic point of view, and Prof. Thomson has expressed himself much pleased with the results obtained. The mechanical arrangements connected with the fitting up of this instrument were devised and executed with much skill by Mr Beckley, the Mechanical Assistant, who has also recently made a working drawing of the instrument for Prof. Thomson, who intends to publish a description of it.

The arrangements made by Mr Francis Galton, in the Observatory Park, for testing sextants, and which were alluded to in last Report, are now almost complete; and six sextants sent by Capt. Washington, R.N., Her Majesty's Hydrographer, have been verified.

The Observatory was honoured with a visit from His Imperial Highness Prince Napoleon, on the 9th of September last. His Highness expressed much satisfaction at witnessing the efficient state of the Institution.

Application has been made to the Commissioners for the International Exhibition of 1862, for a space of 40 feet by 20, in which to exhibit as many as possible of the instruments in use at the Observatory, including those which are self-recording.

The Committee desire to express their thanks for a valuable addition which has been made to the Library at Kew, consisting of a very large number of the Greenwich publications, presented to them through the kindness of the Astronomer Royal.

It will be observed by the annexed statement, that the expenditure of last year has exceeded the income by about £90; but as this year comprised five quarters, it is hoped that the usual annual grant of £500 will cover the expense until the next Meeting of the Association.

John P. Gassiot, Chairman.

Kew Observatory, August 30, 1861.

Accounts of the Kew Committee of the British Association, from June 18, 1860, *to September* 4, 1861.

RECEIPTS.

		£	s.	d.
Balance from last Account,		11	8	5
Received from the General Treasurer,		500	0	0
For the verification of Instruments—				
From the Board of Trade	£7 18 0			
From the Admiralty	17 6 0			
From Opticians	56 1 0			
		81	5	0
From the Donation Fund of the Royal Society for the verification of Magnetographs		90	0	0
From Prof. Wm. Thomson for expenses connected with his self-recording Electrometer, and labour bestowed upon it		36	15	8
Balance		79	3	7
		£798	12	8

PAYMENTS.

	£	s.	d.
Salaries, &c.—			
To. B. Stewart, five quarters, ending October 1, 1861	250	0	0
Ditto, allowed for petty travelling expenses	10	0	0
C. Chambers, five quarters, ending October 6, 1861	125	0	0
G. Whipple, four quarters, ending June 18, 1861	40	0	0
Ditto, one quarter, ending September 18, 1861	12	10	0
R. Beckley, 62 weeks, ending September 2, 1861 at 40*s*.	124	0	0
T. Baker, 11 weeks, ending September 10, 1·60, at 8*s*.	4	8	0
Ditto, 26 weeks, ending March 11, 1861, at 10*s*.	13	0	0
Ditto, 25 weeks, ending September 2, 1861, at 12*s*,	15	0	0
Apparatus, Materials, Tools, &c,	43	14	1
Ironmonger, Carpenter, and Mason	30	6	9
Printing, Stationery, Books, and Postage	23	10	9
Coals and Gas	49	0	2
House Expenses, Chandlery, &c.	17	16	2
Porterage and Petty expenses	12	6	9
Cost of surrounding Inclosure with a Ditch, and of planting a Hedge	17	10	0
Rent of Land to 10th October, 1861	10	10	0
	£798	12	8

I have examined the above account and compared it with the vouchers presented to me, and I find that the amounts expended exceed those received by the sum of £79 3*s* 7*d*; and that the expenditure for salaries, &c., this year is for one year and a quarter, that in the last account having been for three quarters of a year only.

16th August, 1861. **R. Hutton.**

Prof. Phillips read the

Report of the Parliamentary Committee.

The Parliamentary Committee have the honour to report that on the 19th of July they met the Steam Performance Committee, by appointment, at the Admiralty, and had, in company with the members of that Committee, an interview with the Duke of Somerset.

That in the course of that interview the chairman of your Committee shortly explained the motives which had induced the British Association to appoint the Steam Performance Committee, and called upon Mr Fairbairn, who thereupon stated and explained the principle suggestions contained in the report of the Steam Performance Committee, which had been prepared and agreed upon, and will be presented to this meeting: and urged upon his Grace the expediency of carrying them into effect.

The Duke of Somerset, in reply, stated certain objections which he entertained to some of the suggestions, founded chiefly upon the circumstances that sufficient time could not be allowed for the various experiments consistently with the interests of the service, and that the ships of the Royal Navy only employed steam occasionally, and only as an auxiliary power; but his Grace was understood to agree to supply such information to the scientific public as could be done without improperly interfering with the performance of ordinary duties.

The Dukes of Devonshire and Argyll, the Earls of Enniskillen, Harrowby, Rosse, and De Grey, Lord Stanley, and Sir J. Pakington, must be considered as having vacated their seats in your Committee in pursuance of the resolution adopted at Liverpool in 1854; but your Committee recommend that they should be re-elected. Your Committee also recommend that the two vacancies in the House of Commons' List be filled by the election of Sir Joseph Paxton and Lieutenant-Colonel Sykes.

Wrottesley, Chairman.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER, EXPLOSIONS.

At the last ordinary monthly meeting of this Association—W. Fairbairn Esq., C.E., F.R.S., president, in the chair—Mr L. E. Fletcher, chief engineer, presented his monthly report, from which we have been furnished with the following extracts:—During the past month the ordinary visits of inspection have been made and the following defects discovered: Fractures, 9; corrosions, 12; safety-valves out of order, 11; pressure gauges out of order, 8; blow-off cocks out of order, 3 (1 dangerous); furnaces out of shape, 5 (2 dangerous); over-pressure, 5;—total 53 (3 dangerous); boilers without glass water gauges, 59; without pressure gauges, 2; without blow-off cocks, 6; without back pressure valves, 33. Three boiler explosions have occurred during the last month, from which loss of life resulted, in every instance, as well as serious injury to several persons. Not one of these boilers, however, was under the inspection of this association. I have examined the remains of two of them, and have found that both boilers were of the plain double-flued cylindrical construction, such as are in general use in Lancashire, and that explosion had resulted in each of them from collapse of one of the internal furnace or flue tubes. The first of these boilers was 33 feet long, the diameter of the shell being 7 ft. 9 in., and of the internal flue 3 ft. 2 in., while the thickness of the plate, both in the cylindrical part of the shell as well as in the internal flue, was three-eighths of an inch. This boiler had been worked at a pressure of 50 lbs. on the square inch, and at the time of explosion was stated to have been working at upwards of 40 lbs., its age being 10 or 11 years. The second boiler was 30 ft. long, the diameter of the shell being 7 ft. 6 in., that of the internal flues 3 ft., while the plates of the cylindrical part of the shell were seven-sixteenths thick, and of the internal flues three-eighths of an inch. The pressure at which this boiler was worked, and at which it was stated the valves were blowing off at the time of the explosion, was 63 lbs. to the square inch, the boiler being about 5 years old. Neither of these boilers, even when new, were equal to the pressure at which they were worked at the time of the explosion, and must, therefore, for some time have been working in imminent danger. The internal flues were parallel throughout their entire length, and in neither case strengthened by angle iron hoops, T iron hoops, or any other means, while they were considerably coated with incrustation, which thus greatly increased the danger. All boilers of such proportions as the above are weaker in the flues than in the shell, and since the strengthening of these internal flues can be so readily accomplished by the hooping referred to above, while the results of collapse are so disastrous, it appears to me that it is running a most unwise hazard to neglect the simple precaution of strengthening the flues in this way, however slight the pressure may be. I may add, that incrustation on internal flues should be considered not merely as a matter of inconvenience, but frequently of positive danger. Competent inspection would have detected the dangerous condition of these boilers, and prevented the disastrous results, while for want of such inspection many boilers may be in a similar condition quite unknown to their owners.

MONTHLY NOTES.

MARINE MEMORANDA.

The Phœnix.—A handsome screw-steamer, for the Danish Steam Navigation Company, was launched from the building-yard of Messrs James Henderson & Son, at Renfrew, on the 5th ult. The ceremony of christening the vessel the *Phœnix* was most gracefully performed by Mrs Lemmich, of Glasgow. On the *Phœnix* appearing in her natural element, her symmetrical and beautiful model called forth expressions of admiration from all present. She has been specially built to convey the valuable produce of the countries surrounding the Baltic to the British Islands; and, as the traffic has necessarily to be carried on in the most boisterous weather, everything conducive to strength and sea-worthiness has been adopted to enable her to contend with the severities of a North Sea winter passage. Her dimensions are as follow:—Length, 200 feet; beam, 26 feet; depth, 16 feet. She has seven watertight bulkheads, and is so built as to carry a full cargo of grain in bulk. Her machinery is of the most powerful description, being on the four-cylinder principle, patented by the builders, and so successively adapted by them to several of their screw steamers. The *Phœnix* has been built under the special survey of Lloyd's, and of the Danish General Steam Navigation Company's able superintendent, Capt. L. H. Carl, of Copenhagen, who will now take the command of the steamer, and place her on her destined station between Konigsberg, Copenhagen, and Hull.

The Defence.—This noble steam frigate, 22 guns, 600 horse power, was conducted round from the Tyne to Chatham on the 5th ult. The *Defence* crossed Shields bar at 4 p.m. on Thursday, and at 10 o'clock the same evening left the mouth of the Tyne. Her engines, which were under the control of Mr Ollis, worked admirably, and notwithstanding that only half speed was maintained, and occasionally scarcely that, 10½ knots an hour was easily made, the screw making 52 to 60 revolutions per minute, with a pressure of steam of only 20lb. During the run round the coals fell short, and wood had to be burnt in the furnaces. For six hours after leaving the Tyne violent southerly winds were experienced, but subsequently the wind was light from the south and south-west. The *Defence* being the first of the iron-plate frigates which has actually been at sea, great anxiety was felt as to how she would behave when meeting the swell which always sets in from the German Ocean, coupled with a strong gale. The result, however, has been most satisfactory, the huge vessel pitching but very slightly. Although without a single spar or an inch of canvas set, she steamed as steadily and was as easily managed as a river steamboat. The engines were never once stopped until the Shipwash was reached at 12 p.m. on Friday, 26 hours after leaving Tynemouth, the distance run during that time being 210 miles, the steamer never once being at full speed. The *Defence* left the Shipwash, where she had anchored for the night, at 6 a.m. on Saturday, and dropped her anchor off Chatham dockyard at 12·45 p.m. Immediately on her arrival, which was altogether unexpected, she was visited by Captain Schomberg, superintendent of the steam reserve at Chatham, who arrived from his flagship *Cumberland*, 74, in the *Sandfly* gunboat, with the other officials of Chatham dockyard, who spent some time on board. Later in the afternoon she steamed higher up the harbour and was placed alongside the floating shears. Notwithstanding her great size this was accomplished with the greatest ease, the large frigate being as manageable as a boat. About 120 hands arrived at Chatham in her, 80 of whom had been sent from the factory of Messrs Palmer Brothers, at Jarrow, her builders, to assist in completing her at Chatham. The third dock, in which she is to be placed, was made ready for her reception, the Admiralty having sent down directions for the utmost despatch to be used in completing and preparing her for sea.

MISCELLANEOUS.

Patent Laws in Canada.—Several of our readers are probably aware that in Canada only residents are allowed to obtain Patents. We are glad to learn that a Committee of the Board of Arts and Manufactures for Upper Canada, has reported that it thinks it highly desirable that amendments should be made to the Patent Laws of that Province, on the basis of a bill introduced by Mr Lemeiux in the session of 1859, giving to British subjects non-resident in Canada, and Foreign subjects, the right to obtain Patents in this Province on paying an amount equal to the fees and charges that may be payable, at the time of such application, by a Canadian inventor to secure a Patent in the country of the applicant. Restricting grants of patents to British subjects, actual residents of Canada, is believed to be impolitic, and leads to constant evasions of the laws of the Province, and consequent frequent litigations.

South Africa.—The island of Ichaboe, with its dependencies, had been annexed to the Cape Colony. The island was taken possession of by Captain Jones, of her Majesty's ship *Furious*, on the 21st June, and this, with the adjacent islands, was to be put up to public competition on a lease of fourteen years. It has been proposed to annex the whole of independent Kaffraria, from the Kei to Natal. This country, said to be the future garden of Africa, has a coast line of about two hundred miles in length, an extent inland of about one hundred miles, and is therefore about one-half the size of England and Wales united. Its largest inland frontier is adjacent to the district of Queen's Town and Albert, in the eastern province of the colony of the Cape of Good Hope, and to the new province of British Kaffraria on the eastern side of the latter. The area of about 20,000 square miles is very fertile throughout nearly its whole extent. It is well watered by two principal rivers and many smaller streams.

The Elswick Works.—There are 3000 men and boys employed upon the Elswick ordnance and engine works, and their united wages amount to more than £2500 a week. The Elswick ordnance works are being largely extended. Among the more recent additions is an apparatus for the manufacture of cannon of weight and strength hitherto unheard of. An immense 300-pounder battery gun is in the course of being formed by the use of the new 10-ton steam-hammer, which can be worked up to 15 tons, and is the largest in England, and is daily wrought at from 40 to 50 strokes a minute. The anvil weighs 34 tons. The bore of the 300-pounder gun will be 10½ inches in diameter; length, 14 feet; weight, 12 tons. It will be a muzzle loader, and the rifling of its bore will be on the rib pattern. It is expected to be finished in four months. There is also in hand a 200-pounder breach loading gun, to be constructed on the wedge principle. Extensive foundries are being laid out upon the works, and a test for trying the guns before they are sent up to Woolwich is being built on the south side of the Tyne. Among the orders being executed in the engine department of those works are 13 locomotives for the East Indian Railway Company.

Railways.—The following synopsis of the capital already authorised and raised on behalf of the railways of the United Kingdom is taken from official reports.

Capital Authorized.

	Dec. 31, 1860.
Shares, ...	£298,685,142
Loans, ...	100,729,685
Total capital authorised, ...	£399,414,827

Capital Paid-up.

Ordinary shares, ...	£190,791,067
Preference shares, ...	67,873,840
Debenture stock and funded debt, ...	7,576,874
Capital raised in loans, ...	81,888,546
	£348,130,327

The immense sum which represents the railway interest of this country is now about one-half of the amount of the National Debt.

Variegated Printing on Fabrics.—M. Godefroy, a French manufacturer, has patented in France a fabric printing machine with a single roller, which produces an infinite variety of patterns at a very low price. He uses a small roller, the surface of which is roughened in every possible manner, regularly or irregularly, continuously or otherwise; it is driven by the presser in a direction opposite to that of the fabric to be printed, and a reciprocating movement may be imparted to it when required. The fabric in passing over this movable roller receives the impression of its roughened surface, and is displaced at different times; this displacement is such that the roughened parts only of the engraved roller come in contact with the fabric. The roller is placed to the machine either at first or on the second passage of the fabric, and thus any desired number of regular or irregular patterns may be obtained which cannot be imitated by a polychromatic machine. All these different effects are produced by the same roller. If the roller be roughened in a regular manner, the patterns will be regular and continuous, otherwise they will vary, but will be produced at regular intervals as the roller rotates. Independently of the rotating movement imparted to the roller by the presser, a reciprocating movement may be imparted to it when required, and the patterns made to vary indefinitely.

Patent Laws.—The Patent Law Committee of the Social Science Congress have passed the following resolutions:—1. That all applications for grants of letters patent should be subjected to a preliminary investigation before a special tribunal. 2. That such tribunal should have power to decide on the granting of patents, but it should be open to inventors to renew their application notwithstanding previous refusals. 3. That the said tribunal should be formed by a permanent and salaried Judge, assisted, when necessary, by the advice of scientific assessors, and that its sittings should be public. 4. That the same tribunal should have exclusive jurisdiction to try patent causes, subject to a right of appeal. 5. That the jurisdiction of such a tribunal should be extended to the trial of all questions of copyright and registrations of design. 6. That the scientific assessors for the trial of patent causes should be five in number, to be chosen from a panel to be nominated by the Commissioners of Patents, for the adjudication upon facts, when deemed necessary by the Judge, or demanded by either of the parties. 7. That the right of appeal should be to either of the Courts of Exchequer Chamber, with a final appeal to the House of Lords. 8. That, for the preliminary examination, the assessors, if the Judge require their assistance, should be two in number, named by the Commissioners of Patents from the existing panel; the decision to rest with the Judge. 9. That the committee approve of the principle of compelling patentees to grant licences on terms to be fixed by arbitration, or, in case the parties should not agree to such arbitration, then by the proposed tribunal, or by an arbitrator or arbitrators appointed by the said tribunal.

SWEDEN.—The public debt, which has been exclusively incurred for the construction of railways, amounts only to about 2,200,000*l.*, and by means of the sinking fund it will be extinguished in 38 years. No increase of taxation has been made to pay either the interest or sinking fund on this debt, both having been provided out of the surplus of the revenue. The brandy distillation of Sweden is the most important branch of the national industry, and the tax levied on brandy is, after the receipts derived from the Customs, the largest item in the revenue, amounting to about 400,000*l.*, or nearly a fourth of the whole income of the State. The mercantile navy of Sweden at the close of 1859 consisted of 3,364 vessels, with a tonnage of 157,456 lasts, being an augmentation, compared with the preceding year, of 61 vessels and 6,625 lasts. The whole number of workmen employed in mining and in ironworks is about 19,400, but the production of iron in Sweden does not increase, as the smelting of the ore by the use of wood, although it produces iron of a superior quality, is attended with increased expense as the forests are gradually consumed, and renders it impossible for Swedish iron to compete in foreign markets with the iron produced by the more economical agency of coal. The other manufactures of the kingdom consist chiefly of cotton goods, cotton yarn, silks, tobacco, and paper, employing 29,314 hands. In 1850 the total population was 3,500,000, of whom about two-thirds were connected with the cultivation of the soil. Although Sweden 30 years ago imported corn nearly every year she now exports from 500,000 to 1,500,000 imperial quarters annually.

SCIENCE INSTRUCTION TO THE INDUSTRIAL CLASSES.—The first annual examination of science classes, under the minutes of the Committee of Council on Education, took place last month. This examination is open to any persons, of whatever age or sex, who choose to present themselves, and is held in different places in the kingdom, and superintended entirely by the voluntary action of local committees. For the late examination there were 35 local centres. The examination papers were prepared by examiners in London, and sent by post to the local committees, by whom the examination was held in each subject simultaneously all over the kingdom, and the worked papers were returned by the first post to London, for revision. One thousand papers were thus sent up, which represent rather a fewer number of candidates, as the same person might be examined on more than one subject. Seven hundred and twenty-five papers were considered good enough to be passed, of which 310 were up to the standard for Queen's prizes, 59 first-class, 100 second class, and 151 third-class. Queen's prizes are awarded. Besides these, four gold, eleven silver, and 16 bronze medals have been awarded, among the candidates, which leaves three gold, three silver, and five bronze medals unawarded of those offered, in consequence of candidates not having in some subjects done sufficiently well to merit them. The State incurs no expense in the training of teachers, but merely certificates them after examination as competent; and such teachers receive a payment in respect of each student earning his livelihood by manual labour; but the grant is only made after the student has been examined and has proved the sufficiency of his instruction.

ILLUMINATING GAS.—According to a recent patent, it has been proposed to place near to gas burners a receptacle containing coal naptha. The gas, passing through or over this, takes up and becomes enriched by the addition of the volatile hydrocarbons contained in the naphtha, and the illuminating power of the gas is thereby increased. The quality of the naptha employed determines mainly the degree of illuminating power gained, and chemical and photometrical experiments show that it varies from 25 to 77 per cent. The experiment being one in which the gas companies are much interested, one of the London Companies was asked to assist in testing by experiment the value of the invention. The lamps experimented upon were twelve in number; six fitted with the ordinary batswing burners, calculated to consume upon the average of the night 5 cubic feet of gas per hour; and six fitted with batswing burners, calculated to consume 2½ cubic feet per hour. The latter burners having attached to them the carburating apparatus of the United Kingdom Carburating Gas Company, the present owners of the patent in question, each of the twelve burners had a meter attached to it to ascertain the actual consumption. No pressure regulators were fixed upon the lamps. After a month's trial, the following results were obtained:—The burners without the carburating apparatus consumed about 4.39 cubic feet per hour, whilst the burners fitted up with the carburating apparatus consumed about 2.09 cubic feet per hour. It is much to be regretted that no photometer was employed to reduce the experiment to a scientific investigation. Individual judgment only was appealed to, and whilst some assert that the amount of light was perfectly equal in the two classes, others were of opinion that the light of the 2½ feet burners was upon the average of the month inferior, although but very slightly to that of the 5 feet burners. The naphtha employed was of the best quality. Taking the lowest estimate of the improvement effected, it may be concluded that with naphtha of equal quality to that used, during the warm months of the year, 3 cubic feet of carburated gas may be considered as about equal to 5 cubic feet of gas not carburated. Assuming this to be data applicable to all seasons of the year, the saving to be effected by the process, after allowing for the cost of the apparatus, and for periodically filling it with naptha, and after giving credit at the present price of the gas supplied to the public lamps, for the quantity not consumed, would be for each public lamp at least 20s per annum, and, there being 2825 lamps within the City of London, a saving of about £2825 would be annually effected.

INDUSTRIAL SCHOOLS ACT.—By the 24th and 25th Vict., c. 113, which is now in operation until the 1st January, 1864, the law as to industrial schools in England is amended and consolidated. The mode of certifying and sanctioning the establishment of these schools is, as before, through the Home Secretary, upon the application of the managers of any school "in which industrial training is provided, and in which children are clothed, lodged, and fed, as well as taught," and after inspection of the premises by an authorised officer. The law has more clearly defined than in the previous act of 1857 what children are liable to present to industrial schools. Before any description of vagrant might have been confined therein; but now, by the 9th section, children of the following descriptions only can be sent in pursuance of the act—viz., "1. Any child apparently under the age of 14 years found begging or receiving alms, or being in any street or public place for the purpose of begging or receiving alms. 2. Any child apparently under the age of 14 years that is found wandering, and not having any home or settled place of abode, or any visible means of subsistence, or frequents the company of reputed thieves. 3. Any child apparently under the age of 12 years, who, having committed an offence punishable by imprisonment or some less punishment ought nevertheless, in the opinion of the justices (regard being had to his age and to the circumstances of the case) to be sent to an industrial school. 4. Any child under the age of 14 years whose parent represents that he is unable to control him, and that he desires such child to be sent to an industrial school, in pursuance of this act, and who at the same time gives such undertaking or other security as may be approved by the justices before whom he is brought in pursuance of this act, to pay all expenses incurred for the maintenance of such child at school, provided that no child who, on being brought before the justices, is proved to have been previously convicted of felony, shall be deemed to be within the provisions of this act."

MINERAL OIL SPRINGS.—In the United States the principal deposits are understood to be close to a station on a new railway—the Atlantic and Great Western—which will render their conveyance to New York comparatively inexpensive. In Canada they are about 12 miles from the Wyoming Station of the Great Western of Canada Railway, and some arrangements will be necessary for the transit over that distance, the existing roads being of the worst description. At the site of the principal wells the ground was two years ago covered by an almost unbroken forest. Now there is a resident and constantly increasing population of upwards of 500. During last winter the coaches took an average of 50 people daily to the spot from Wyoming, and many bought land and remained. There are several inns, and two hotels are in course of erection. Houses and shanties are rising on all sides, and the greatest activity is everywhere apparent. At present there are about 100 wells in full operation, all yielding oil. The land is held in large blocks, the owner leasing acres and half acres for 99 years. The terms usually are 300 dols. for the privilege of one-third of the oil drawn from the wells. The wells are sunk and cribbed to a depth of from 40 to 60 feet till the rock is reached. In many cases surface oil is found before reaching the rock, but it is of rather inferior quality and doubtful yield. After arriving at the rock, the wells through the earth being from 4 to 7 feet square, they drill to a depth of from 40 to 70 feet, between which distances oil is almost sure to be discovered. Wooden tanks, varying from 500 to 2000 gallons capacity, are constructed close to each well. The oil is pumped into these, and afterwards drawn off into barrels to be sent to market. The cost of a well is very small. Parties are in the district making contracts for sinking wells. Their charge is for sinking through the earth 2½ dols. per foot, and for drilling through the rock 2¼ dols. per foot. A well after being commenced usually yields oil in less than 30 days. At these prices a well can be sunk, a tank for 100 gallons made, and a pump and all necessary appliances provided for a sum equal to about £100 sterling. When oil is found, one man at 4s a day can readily pump 100 barrels, or 4,000 gallons a day. The cost of the oil, including every expense, and calculating the reimbursement of every outlay incurred in one year, and also calculating a yield of 15 barrels, or 600 gallons, a day, is, it is alleged, absolutely less than a halfpenny sterling a gallon delivered into the tank alongside the well. Very few attempts have yet been made to pump by steam at the place where the oil is most extensively found, nearly all the labour being by hand. This is partly to be attributed to the badness of the roads, preventing the possibility of getting heavy loads into the district, and partly to the yield of the wells being on an average about equal to the quantity a man can easily pump in a day. A moderate average yield for all the wells now in operation (100) is 15 barrels or 600 gallons, a day. At the rate at which privileges are being disposed of and parties are preparing to sink wells, there will be 500 in operation before Christmas. Taking the present 100 wells only, however, the result is extraordinary. Thus—100 wells yielding 600 gallons give 60,000 gallons per day, 360,000 per week, or 18,720,000 per annum.

AMORPHOUS PHOSPHORUS.—The deleterious influence which common phosphorus exercises on the health of those employed in the manufacture of lucifer matches renders it highly desirable that it should be superseded by the use of that form of phosphorus which is known as amorphous, the employment of which is attended with no evil consequences. This form was discovered in 1848 by Prof. Schrölter of Vienna, and its mode of production is thus described in the *Chemical News*:—Ordinary purified phosphorus is placed under water in a cast-iron boiler over a furnace, then melted, cooled, and the water removed from its surface. The vessel is then immediately and securely closed, air-tight, (except a small iron tube for the escape of vapour) by a cast-iron cover. The lid has a vertical iron tube, closed at its lower end, fixed in it, which projects downwards into the phosphorus, and is open at its upper end for the reception of a thermometer. Heat is now gradually applied by means of the furnace until the phosphorus is about 450° Fah., and that temperature is maintained for a greater or less period of time, according to the amount of phosphorus operated upon, and the mass is then allowed to cool. A quantity of about 200 pounds is kept heated for about three or four weeks. After this process the vessel is opened, and the phosphorus, which has now become a hard, red brick-like substance, is covered with water, and extracted by means of iron bars, &c. This process of conversion requires to be conducted with great circumspection, otherwise (from over-heating of the phosphorus) fearful explosions may ensue; experience has, however, shown that they may be almost wholly avoided. For commercial purposes the red or amorphous phosphorus, as it is termed, is required to be in a state of fine powder; the stony fragments are, therefore, broken into small pieces under water in a mortar, and ground under water between pieces of millstone in a vessel supplied with a small stream of water, which carries off the finer particles in its overflow stream into a large tank, where they gradually subside, or into a filter where they are collected. A process is then resorted to for the separation of any ordinary phosphorus which the powder may contain. This wet and finely-divided substance having been dried, sifted, and packed in air-tight tins, is ready for sale. The two forms of phosphorus differ from one another only in external appearance, and in the aggregation of their particles; chemically speaking, they are the same substance. Their different physical properties may be thus epitomised for comparison:—

Common Phosphorus.	Amorphous Phosphorus.
Poisonous.	Innocuous.
Emitting a strong odour.	Nearly odourless.
Phosphorescent—luminous in the dark.	Nonphosphorescent and illuminous.
Melting point, 108° Fah.	Melting point, 500° Fah.
Transparent.	Opaque.
Almost colourless.	Varying in colour from nearly black, with a metallic lustre to iron gray, brick-red, crimson and scarlet.
Freely soluble in various liquids.	Nearly insoluble in all liquids.
Distinctly crystalline.	Amorphous.
Soft, may be indented by the nail.	Hard as a brick.
Flexible as copper or lead.	Brittle as glass.
Quickly igniting on exposure to air.	Uninflammable when exposed to air.

Sulphide of phosphorus has been recently suggested as a substitute for phosphorus for lucifer matches. It is directed to be made of four parts of phosphorus and one of sulphur coarsely powdered, and covered with water at a temperature of 100° Fah. in a porcelain vessel. The sulphide is formed as a liquid in a few minutes. The water must then be poured away, and a thick solution of gum added cold. The sulphide thus formed is liquid at 32°, and is more easily inflamed by friction than phosphorus itself. Mixed with other ingredients, such as peroxide of lead, sulphide of antimony, and nitrate of lead, it is said to form an excellent composition for the purpose.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

9th August, 1861.

1987. Alfred V. Newton, Chancery Lane—Improved machinery for sewing.—(Communication from Amasa Howe, New York, U.S.)

1988. Charles Lee and Thomas K. Mace, Birmingham, Warwickshire—An improvement or improvements in backing or covering the backs or foundations of raised and cut pile fabrics.

1989. James Gray, Thomas Kershaw, Benjamin Crowther, and Alfred Dean, Manchester, Lancashire—Improvements in mules for spinning.

1990. Richard A. Godwin, Newport Street, Paradise Street, Lambeth, Surrey—Improvements in pumps.

1991. Adrien F. B. Falgas, Rue de Malte, Paris—Improvements in the composition of bandages for hernias and of hypogastrick girdles.

10th August, 1861.

1992. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in the construction of tents for military and other purposes.—(Communication from Francois A. Chapelle, Louis Caron, and Alexandre Arniot, Paris.)

1993. Alexander S. Stocker and Alexander R. Stocker, Wolverhampton, Staffordshire—Improvements appertaining to horse shoes, boot heels, wheel tyres, rails, safes, and other useful purposes.

1994. Henry Wilde, Manchester—Improvements in electro-magnetic telegraphs, and in apparatus connected therewith.

1995. William S. T. Clarke, Charing Cross, Westminster—A railway break.

1996. Theodore Schneider, Horseferry Road, Westminster, and Charles E. Crawley, Gracechurch Street—Improvements in inlaying wood, ivory, and other substances, and in apparatus employed therein.

1997. Andrew Barclay, Kilmarnock, Ayrshire—Improvements in machinery or apparatus for raising, lowering, or moving heavy bodies.

1998. Montague Wigzell, Friars Green, Exeter, Devonshire—A machine or apparatus for twisting ordinary nails and all other similar driving articles of a parallel or tapered form, and of a plain, fluted, grooved, or indented section throughout or in part.

1999. Montague Wigzell, Friars Green, Exeter, Devonshire—A machine, apparatus, or machinery for making plain twisted nails, spiral fluted nails, and other similar driving articles of a twisted or spiral fluted form throughout or in part.

12th August, 1861.

2000. Hugh Greaves, Abingdon Street, Westminster—Improvements in apparatus to be employed for the water conveyance and delivery of coals and other materials.

2001. Antoine Garzend, Boulevart St. Martin, Paris—A new or improved apparatus for scraping wood of any kind, especially applicable to dye woods.

2002. William E. Gedge, Wellington Street, Strand—Improved breaking apparatus for railway and other vehicles.—(Communication from Alfred Tahuteau, Bordeaux Gironde, France.)

2003. William Edwards and Eli Edwards, Coventry—Improvements in or apparatus applied to the breaks of railway carriages.

2004. Aaron Salomons, Old Change—A new or improved article of female apparel.—(Communication from Gerard Higgins, New York, U.S.)

2005. Vincent Jankowski, Princes Street, Fitzroy Square—Improvements in means or apparatus to facilitate the sawing of wood and other substances.

13th August, 1861.

2006. John H. Elvans, Guildford Place, Lower Kennington Lane, Surrey—An improved steel husk or stay fastening.

2007. Joseph Humpage, Balsall Heath, King's Norton, Worcestershire—A new or improved reaping and mowing machine.

2008. John C. Horner, Avenue Road—Certain improvements in looms for weaving.—(Communication from Messieurs Escher Wyss and Company, Zurich, Switzerland.)

2009. Joseph Jacob, Golden Square—Improvements in producing on porcelain and other ceramic products, on glass, venetian enamels, and on metallic surfaces, designs in colours, and in gold, silver, and other metals.—(Communication from Franz Kosch, Vienna, Austria.)

2010. John Lancaster, Princes Street, Bedford Row—A new method of producing sand.

2011. Samuel Andrew and Stephen Hornby, Stalybridge, Lancashire—Improvements in machinery or apparatus for opening, cleaning, and preparing cotton and other fibrous materials.

2012. Jacques G. Remy, Brussels, Belgium—Improvements in the manufacture of articles of furniture by utilizing certain parts of the cedar tree in such manufacture, which have heretofore been considered and treated as waste.

2013. Christopher Binks, Gray's Inn—Improved methods of and apparatuses for treating linseed and other oils and fats.

2014. Nicholas Common, Brighton, Sussex—Improvements in apparatus applicable to water-closets and urinals.

2015. Benjamin Cooper, Frome, Somersetshire—Improved machinery for spinning and doubling fibrous materials.

14th August, 1861.

2016. William Robertson, Manchester—Certain improvements in machines for preparing to be spun cotton and other fibrous materials.

2017. Edward A. Rippingille, Prestolee Farnworth, Manchester—Certain improvements in steam engines.

2018. Nathaniel Cox, Cheshire—Improvements in the construction of iron ships, the said improvements relating to the method of attaching or securing bulkheads to the frames or ribs thereof.

2019. William E. Gedge, Wellington Street, Strand—Improvements in pressing boards for pressing cloth and other fabrics.—(Communication from Edouard Henry, Amiens, France.)

2020. Francois Durand, Paris—Improvements in the manufacture of metallic tubes.

2021. Alcidalis A. R. Damoiseau, Paris—An improved construction of kiln for baking bricks, tiles, or other similar articles.

2022. George J. Wainwright, Dukinfield, Cheshire—Improvements in certain parts of machinery or apparatus used in preparing and spinning cotton or other fibrous materials.

2023. Richard A. Brooman, Fleet Street—Improvements in coating wire with copper, silver, gold, or other metal or alloy in order to prevent oxidation.—(Communication from Martin Miller, Vienna, Austria.)

2024. Edmund Edwards, Beaufort Buildings, Strand—Improvements in machinery or apparatus for separating mineral ores, coal, and other substances from impurities.

2025. Thomas Silvester, West Bromwich, Staffordshire—Improvements in spring balances or weighing apparatus.

2026. William Wilds, Hertfordshire—Improvements in apparatus for ventilating.

2027. John Billing, Abingdon Street, Westminster—Improvements in stoves.

15*th August*, 1861.

2028. Adolphe Lebaudy, Rue de Douai, Paris—Improvements in towing vessels or boats on rivers.—(Communication from Jean F. Cail, Paris.)

2029. Stephen Carey and William M. Pierce, East Ham, Essex—Improvements in apparatus for reburning animal charcoal.

2030. Joseph C. Rivett, John Vickers, and Samuel Hayes, Farnworth, Manchester—Improvements in machinery and apparatus for spinning and doubling fibrous materials.

2031. John Bethell, King William Street—Improvements in the making of journals, axle boxes, and bearings for machinery, axles, and spindles to work in smoking pipes, buttons, crucibles, and pots for chemical and smelting purposes, and also of a lubricating compound for railway and other carriages.

2032. John C. Martin, High Street, Barnes, Surrey—An improvement in treating bones, and the manufacture of the products thereof.

2033. Philip Webley and Thomas W. Webley, Birmingham, Warwickshire—A new or improved elevating rifle sight.

2034. Francis A. Kain, Redhill, Reigate, Surrey—An improved manufacture of artificial stone or earthenware applicable for bricks, tiles, retorts, railway sleepers, and other articles.

2035. John T. Hutchings, Charlton, Kent—An improvement in the construction of tennis and racquet hoops with handle.

2036. Spendlove Desborough, Noble Street, St. Martin's-le-Grand—Improvements in the manufacture of umbrellas and parasols.

2037. Augustin F. Menard, Rue de Strasbourg, Paris—Improvements in tanning and in the apparatus employed therein.—(Communication from Yves A. Rehm, Basse Yutz, Moselle, France.)

2038. Charles W. Kesselmeyer, Manchester, and Thomas Mellodew, Oldham, Lancashire—Improvements in the manufacture of velvets and velveteens.

2039. James Comhe, Belfast—Improvements in machinery for heckling flax and and other fibrous substances.

2040. Julian Faucherro, Green Terrace—An improved mode of manufacturing gold dials.

2041. Richard D. Chateerton, Highbury Terrace—Improvements in transmitting motive power, especially applicable to piston propellers.

2042. Theophilus Murcott and Charles Hanson, Haymarket—Improvements in breech-loading arms.

16*th August*, 1861.

2043. John Livesey, New Lenton, Nottinghamshire—A new textile fabric for embroidery, trimmings, and other ornamental purposes, and machinery employed in making the fabric into trimmings.

2044. Alfred V. Newton, Chancery Lane—Improvements in knitting and in machinery therefor.—(Communication from James G. Wilson, New York, U.S.)

17*th August*, 1861.

2045. Henry C. Hill, Stalybridgo, Lancashire—Improvements in the construction of fire proof buildings.

2046. Thomas Settle Bolton, Lancashire—A certain improvement in machinery or apparatus employed in preparing cotton, wool, flax, and other fibrous substances for spinning.

2047. Ellis Sutton, Radcliffe, Lancashire—Certain improvements in machinery or apparatus for preparing cotton and other fibrous substances for spinning.

2048. Mary H. Randle, Ludgate Hill—An improvement in sous-jappe or under petticoats for distending articles of dress and preserving the shape or form thereof.

2049. Philip Walters, Wolverhampton, Staffordshire—Improvements in machinery for cutting, sawing, and slicing or planing wood and other substances.

2050. Zerah Colburn, Tavistock, Street, Bedford Square—Improvements in apparatus for heating water intended for the supply of steam boilers.

2051. Pleasant Hart, Hampton Wick—An improvement in mills for grinding.

2052. Robert Caunce, Nottingham—Improvements in carding engines.

19*th August*, 1861.

2053. William Bennett, London Street, Paddington—A new composition for the lighting of fires.

2054. Zerah Colburn, Tavistock Street, Bedford Square—Improvements in the construction of suspension bridges.

2055. John Robh, Aberdeen—Improvements in ventilating.

2056. George T. Selby, Smethwick, Staffordshire—An improvement in surface condensers.

2057. Edmund S. Cathels, Shrewsbury, Shropshire—Improvements in compensating gas meters.

2058. William H. Smith, London—Improvements in the preparation, application, and manufacture of peat.

2059. William Gossage, Widnes, Lancashire—Improvements in the manufacture of certain kinds of soap, and in the construction of apparatus to be used in such manufacture.

2060. William Firth, Burley, Leeds, Yorkshire—Improvements in machinery for digging or turning up soil, mowing, reaping, and other agricultural purposes.

2061. Thomas Pedrick, Park Place, Brixton, Surrey—Improvements in obtaining and applying motive power.

20*th August*, 1861.

2062. Benjamin Hargreaves and John Hargreaves, Burnley, Lancashire—Improvements in the valves of steam engines.

2063. George Ingram, Old Street—An improved endless train to be used in connection with the wheels of carriages on common roads.

2064. Augustin S. Rostaing, Dresden, Saxony—Improvements in constructing spectacles, consisting in a new mechanism which I call arch spring lever.

2065. William Fitkin, Fleet Street—Improvements in apparatus or instruments for extracting teeth.

2066. Hannah Emes, Adelaide Road, Haverstock Hill—Improvements in dress fastenings, which are also applicable to other purposes.

2067. Richard A. Brooman, Fleet Street—An improvement in preserving meat and other animal substances.—(Communication from Jean P. Liès-Bodard, Strasbourg, France.)

2068. Richard A. Brooman, Fleet Street—An improved steam mill or apparatus for transmitting motive power.—(Communication from Charles Halphen, Paris.)

2069. Samuel Whittaker, Haverstock Hill, and Ralph A. Jones, Aylesbury, Buckinghamshire—Improvements in operating upon railway signals, and in indicating their position by means of electricity.

2070. Samuel Warwick, Lower Road, Isliugton—An improvement or improvements applicable to concertinas.

2071. John Somerville, Maidstone, Kent—Improvements in apparatus for drilling and tapping gas and water mains and pipes, and in preventing leakage therefrom.

2072. James Platts, Glasgow, Lanarkshire—Improvements in looms for weaving.

2073. Thomas Sutton, King's College—An improved camera for taking photographic portraits and instantaneous pictures.

2074. Richard S. Lambert, White Hall, Clevedon, Somersetshire—An improved "skipping dipper" or vessel for removing sugar and other liquids from boiling pans.

2075. Frederick Gye, Royal Italian Opera, Covent Garden—Improvements in constructing gasometers and gasometer tanks.

2076. George F. Muntz, Freuch Halls, Birmingham—Improvements in sheathing iron ships or vessels.

2077. George F. Muntz, French Halls, Birmingham—Improvements in apparatus for melting metals.

2078. Nicholas Fisher, Milton, near Blisworth, Northamptonshire—Improvements in agricultural implements for grubbing and cultivating land.

2079. James Ellis, Minories—Mechanism for sizing corks or separating the larger from the smaller sized corks.

21*st August*, 1861.

2080. Charles A. Wheeler, Swindon, Wiltshire—Improvements in preventing wind draughts at the foot of doors and allowing them to open over carpets or other substances without the use of rising hinges.

2081. Thomas Lambert, Thorncroft Farm, Great Henny—An improved agricultural implement for rolling ridges and furrows or straight work.

2082. William Masou, Liverpool, Lancashire—An improved soap.—(Communication from Patrick M. Belton, New York, U.S.)

2083. William Clark, Chancery Lane—Improvements in optical and illuminating apparatus.—(Communication from William F. C. de Douhet, Boulevart St Martin, Paris.)

2084. William Clark, Chancery Lane—Improvements in the construction of buildings whereby to utilize the waste heat passing up the chimneys.—(Communication from Léon de Sanges, Boulevart St Martin, Paris.)

2085. Andrew Stein, Edinburgh, Mid Lothian—Improvements in distillation.

2086. Nahum Salamon, Ludgate Street—Attachments or apparatus for sewing-machines.—(Communication from Amara B. Howe, New York.)

2087. Auguste J. Hennart, Tournay, Belgium—A new system of constructing economical smoke-consuming grates.

2088. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Certain improvements in presses for lithographic printing.—(Communication from Heury Voirin, Rue Mayet, Paris.)

2089. Joseph M. Murat, Rue de Malte, Paris—Certain improvements in machinery for shearing mechanically the military pompoons and other articles of the same kind.

2090. Abijah Jervis, Coventry, Warwickshire—Improved machinery for the manufacture of pleated, ribbed, and looped fabrics.

2091. Thomas Green, Smithfield Iron Works, Leeds, Yorkshire, and Robert Mathers, Stoke Newington Green—Improvements in apparatus for transmitting motion to machinery.

2092. Thomas Grahame, Worthing, Sussex—Improvements in the construction of boats, rafts, and other floating structures.

2093. Westley Richards, Birmingham, Warwickshire—Improvements in rifles and projectiles.

2094. James Kane, Templemoyle, near Dungwen, Londonderry—Improvements in treating flax, hemp, and other analogous substances which yield fibres for the purpose of manufacturing from them fibres adapted to be spun into yarn and thread.

22*d August*, 1861.

2095. Arthur I. Mahon, Leinster Square, Rathmines, Dublin—Improvements in screw or spiral propellers, also applicable to raising and forcing water.

2096. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in the preparation of pulp for paper.—(Communication from Mademoiselle J. Françoise-Marie de Cassan and Monsieur Jean P. Meyer, Paris.)

2097. Bernhard Samuelson, Banbury—Improvements in harvesting machines.—(Communication from Owen Dorsey, Matthew's Store, Howard County, Maryland, U.S.)

2098. Edouard Landsberg, ainé, Paris—Improvements in porte-robes or buttons for holding up the skirts of ladies' gowns.

2099. Richard Telford, Birmingham, Warwickshire, and James Sanders, Clifton, Gloucester—A substitute for castors for furniture.

2100. Louis M. Casella, Hatton Garden—Improvements in mercurial thermometers.

2101. Thomas F. Doyle, Guildford Place, Russell Square—Improvements in means or apparatus for raising and forcing fluids.

2102. William Baines, London Works, Smethwick, Staffordshire—Improvements in the construction of girders, frames, or other apparatus fixed or moveable, and for certain peculiar forms or sections of iron used therein.

2103. Thomas Richardson, Newcastle-upon-Tyne, and Robert Irvine, Hurlet, Renfrewshire—Improvements in the manufacture of paper.

23d August, 1861.

2104. Joseph Whitworth and William W. Hulse, Manchester, Lancashire—Improvements in sights for small arms and ordnance, and in fitting apparatus used with small arms.

2105. Mildred Blakey, Leeds, Yorkshire—Improvements in rotary pumps.

2106. Joseph Dunn, Alnwick, Northumberland—An improvement or improvements in reaping machines.

2107. Augustus B. Childs, New Oxford Street—An improvement or improvements in the dressing of millstones, or what is generally known as the cracking of millstones.—(Communication from David M. Childs, Rochester, New York, U.S.)

2108. Samuel Elson, Oldham, Lancashire—Improvements in apparatus for heating the feed water of steam boilers, superheating steam and surface condensation.

2109. William D. Player, Birmingham, Warwickshire—Certain improvements in the description of buttons commonly known as linen buttons.

2110. Richard A. Brooman, Fleet Street—An improved method of treating the hop plant to obtain a material resembling wool.—(Communication from Barthélemy Picard, Nancy, France.)

2111. Henry Ingle, Shoe Lane, and James Ingle, Pimlico—Improvements in printing machines.

2112. William Evans, Willow Walk, and Edward Concanen, Cheshunt Terrace, Grange Road, Bermondsey, Surrey—A new manufacture of pens or writing instruments.

2113. George T. Bonsefield, Loughborough Park, Brixton, Surrey—Improvements in apparatus for feeding boilers.—(Communication from William L. Chase, Philadelphia, Pennsylvania, U.S.)

24th August, 1861.

2114. Michael Hyams, Bath Street, City Road—Improvements in the manufacture of smoking pipes and cigar tubes, and preparing, washing, coating, covering, or otherwise impregnating them with aromatic substances in a solid, liquid, or aeriform state.

2115. Jeremiah Driver, Keighley, and Joseph Jessop, Bradford, Yorkshire—Improvements in means or apparatus employed in washing, wringing, and mangling fabrics, and in the manufacture of part or parts of such apparatus.

2116. William Clissold, Dudbridge Works, near Stroud, Gloucestershire—Improved apparatus for oiling wool.

2117. James Cranston, Birmingham, Warwickshire—Improvements in the construction of conservatories, orchard houses, and other horticultural erections, which improvements are also applicable to the covering of areas such as are used for drill sheds, markets, railway sheds, colonists and army huts, and many other similar purposes.

2118. Henry B. Coathupe, jr., Saint James's—Improvements in timekeepers.

26th August, 1861.

2119. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the propulsion and steerage of ships or vessels, and in the construction and arrangement of the machinery connected therewith.—(Communication from Pierre L. T. Thier, Passage Choiseul, Paris.)

2120. Robert W. Jones, Glenbrook Baths and Hotel, Cork—Improvements in heating and ventilating, especially applicable to Turkish baths.

2121. John Clark, Glasgow, Lanarkshire—Improvements in the manufacture of envelopes and other covers, and in part applicable to the gumming of sheets of paper.

2122. Henry Nelson, Manchester, James Carr, Blackburn, and George Harrison, Burnley, Lancashire—Improvements in self-acting mules for spinning cotton and other fibrous materials.

2123. George Nye, Mount Street, Lambeth, Surrey—Improvements in apparatus for administering injection in a continous stream, also applicable as an eye douche and other purposes.

2124. Auguste Leehene, Stanhope Street, Hampstead Road, and Charles Nathan, Westmorland Street, Pimlico—The manufacture of imitation of embroidery for ladies' collars, cuffs, &c., and all sort of embroidered articles.

2125. John L. Field, Colton Haverthwaite, near Newton in Cartmel, Lancashire—Improvements in the construction of armour plates and in their application to ships and batteries.

2126. Frederick Tolhausen, Boulevart Bonne-Nouvelle, Paris—A kind of fur to be made by means of the Jacquard or other loom with silk or other textile material.—(Communication from Antoine Denis and Adolphe Mottet, Boulevart Bonne-Nouvelle, Paris.)

2127. Frederick Tolhausen, Boulevart Bonne-Nouvelle, Paris—A new and economical method of producing dynamical electricity, thereby obtaining useful chemical compounds.—(Communication from Jean B. T. Rousse, St. Etienne, France.)

2128. John C. Haddan, Bessborough Gardens, Pimlico, and Carlo Minasi, St. James Terrace, Camden Town—Improvements in the manufacture of projectiles and of cartridges.

2129. William E. Newton, Chancery Lane—Improved machinery for filtering liquids, decolorizing saccharine and other juices, and rectifying alcoholic liquors.—(Communication from Horatio N. Fryatt, Belleville, New Jersey, U.S.)

2130. Henry Attwood, Wapping Wall—Improvements in cleansing and in feeding boilers.

27th August, 1861.

2131. Zerah Colburn, Tavistock Street, Bedford Square—Improvements in the arrangement and combination of high and low pressure steam engines.

2132. Emile Peltier, Paris—Improvements in the manufacture of metallic boxes, and in machinery employed thereby.

2133. Louis M. F. Patureau, Paris—An improved thread protecting clew box.

2134. Joseph Smith and William Smith, Keighley, Yorkshire—Improvements in spindles and flyers used in machinery for spinning and twisting fibrous substances.

2135. John C. C. Azémar, Mark Lane—The manufacture of an instrument to facilitate the practice of the drum.

2136. Jean B. Fondu, Lodelinsart, Belgium—Improvements in the construction of fire grates for steam and other boilers, and suitable to all kinds of fires.

2137. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in dampers for stamping purposes.—(Communication from Joseph I. Morel and Jules Lirondelle, Peronne, France.)

2138. Richard A. Brooman, Fleet Street—Improvements in the construction of temples or stretching rollers for looms.—(Communication from Julien Paty, Bernouville, Eure, France.)

2139. John M. Hart, Cheapside, and Robert Lavender, Acacia Cottages, New Road, Hornsey—Improvements in handles or knobs of locks and latches, and in the means of applying them.

28th August, 1861.

2140. Arthur Granger, Holborn—Improvements in the manufacture of shirt collars and fronts, wristbands or cuffs, neck ties, or other similar articles of wearing apparel.

2141. James Ronald, Liverpool—Improvements in machinery for dressing hemp, flax, manilla, and other like long fibrous material.

2142. Benjamin Browne, King William Street—An improved process and apparatus for concentrating ores or tailings or separating pulverized mineral substances of different kinds or qualities from each other.—(Communication from Henry E. Roeder, Broadway, New York, U.S.)

2143. William S. Guinness, New York, U.S.—Improvements in sewing-machines.

2144. Thomas Bray, Dewsbury, Yorkshire—Improvements in ornamenting wood in imitation of inlaid work.

2145. Samuel Carpenter, High Street, Banbury, Oxon—Improvements in the construction of carriage wheels.

2146. James Duncan, Greenock, Renfrewshire—Improvements in the manufacture of sugar.

2147. Meinrad Theiler, Einsiedeln, Switzerland—Improvements in type printing telegraphs.

29th August, 1861.

2148. Samuel Corbett, Park Street Works, Wellington, Salop—Improvements in mills for crushing and grinding mineral and vegetable substances and for hulling or shelling beans and oats and other grain and seeds.

2149. John Harding, Manchester, Lancashire—An improved Inverness cape.

2150. John Love, of Lower Brook Street, Grosvenor Square—An improved signal.—(Communication from Robert Harvey, Lonsdale Street, West, Melbourne, Victoria.)

2151. Victor A. Janvier, Wilton Square, New North Road—Improvements in fastenings for gloves, belts, and other articles.

2152. Philip Jewell, Bond Street, Brighton—Improvements in concertinas.

2153. Alfred V. Newton, Chancery Lane—Improved machinery for cleaning rice and other grain.—(Communication from Albert H. Wright, New York, U.S.)

30th August, 1861.

2154. Robert Penrose, Coley Mill, near Halifax, Yorkshire—Improvements in screw stocks and dies.—(Communication from John Peace, Reading, Pennsylvania, U.S.)

2155. Lemuel D. Owen, New Oxford Street—Improvements in ploughs.—(Communication from Martin Buck, Lebanon, New Hampshire, U.S.)

2156. Robert Shaw, Portlaw, Waterford, Ireland—Improvements in windlasses, capstans, and other machinery for hoisting and lowering weights.

2157. Adrien J. Daumont, Paris—An improved umbrella.

2158. Stanislas Pluchart, Paris—An improved beverage called "Moka-beer."

2159. Alexandre Taille, Agen, Lot et Garonne, France—An improved manufacture of manure.

2160. William E. Gedge, Wellington Street, Strand—Improvements in thrashing machines.—(Communication from Jean F. Dussol, Saint Lys, Haute Garonne, France.)

2161. Henry W. Spencer, Stepney Causeway, Commercial Road—Improvements in the manufacture of animal oils, the said improvements relating more particularly to the processes of refining them to be used for lubricating purposes.

2162. James S. Matthews, Bowling Green Street, Kennington Park, Surrey—Improvements in the manufacture and preparation of starch.

2163. James Harris, Hanwell—Improvements in stopping or retarding railway and other carriages and trains, locomotive and stationary engines and machinery, together with apparatus employed therein, which apparatus is applicable to the raising and lowering of weights and other purposes for which power is required.

2164. Hippolyte Lecauday, Wellington Street, Strand—Improved apparatus for succouring persons interred before life is extinct.—(Communication from Raymond Malerille, Bordeaux, France.)

2165. Charles Worms and James Warburton, Bradford, Yorkshire—Improvements in treating animal fibre recovered from rags, composed of mixed animal and vegetable fibre.

2166. James Bishop, Gloucester Street, Camden Town—Improvements in the manufacture or weaving of velvet or other pile fabrics.

2167. Henry Brand, Guildford Place, Clerkenwell—Improvements in mattresses formed with springs.

2168. William Clark. Chancery Lane—Improvements in shirts and chemises.—(Communication from Madame Sénécal, Boulevart St Martin, Paris.)

31st August, 1861.

2169. William Hensman, Woburn, Bedfordshire, and William Hensman, jr., Linslade, Buckinghamshire—Improvements in apparatus for tilling land by steam power.

2170. Henry Keach, Bedford Terrace, Andover Road, Holloway—An improvement in the ornamentation of woven and other fabrics for garments and parts of garments.

2171. Peter Taylor, City Road, Hulme, Manchester—Improvements in apparatus for removing the sediment from and preventing incrustation in steam boilers.

2172. Thomas M. Jones, Great Pulteney Street—Improvements in apparatus for suspending and turning meat, fowls, and such like articles for roasting.

2173. William Southwood, Barkham Terrace, Saint George's Road, Lambeth, Surrey—An improved method of making boots and shoes, or of parts thereof.

2174. Charles Pemberton, Deptford, Kent—Improvements in railway, ship, and other signals.

2175. John Copple and Edward Copple, Eccleston, near Prescot, Lancashire—Improvements in apparatus to prevent over winding at coal and other mines.

2176. Edward J. Hughes, Chancery Lane—An improved apparatus for collecting the gases which escape from furnaces.—(Communication from Mr Em. Langen, Siegburg, Prussia.)

2177. John Jones, North John Street, Liverpool, Lancashire—Improvements in clasps or fastenings for garments, belts, harness, and like articles.

2178. William A. Gilbee, South Street, Finsbury—Improvements in the process and apparatus for the manufacture of steel.—(Communication from Jules Paulis, Brussels Belgium.)

2179. John M. Dunlop, Manchester—Improvements in cleansing cotton seeds, and in machinery used for such process.

2180. William Fox, Amiens, France—Improvements in parasols and umbrellas.—(Communication from Mr Charageat, Boulevard des Italiens, Paris.)

2181. Charles W. Siemens, Great George Street, Westminster—Improvements in apparatus employed in connection with electric telegraphs, part of which improvements are also applicable to ascertain the heat in inaccessible places.—(Communication from Werner Siemens, Berlin, Prussia.)

2182. Fredric Curtis, Bilston, Staffordshire—Forming or shaping woollen or mixed fabric boot tops or uppers from flat woven material.

2183. Goran F. Goransson, Gefle, Sweden—Improvements in the manufacture of tyres for railway wheels, part of the said improvements being applicable to the consolidating or rendering homogeneous iron and steel for other purposes.

2d September, 1861.

2184. Thomas S. Stock, Joseph S. Stock and Henry Taylor, Birmingham, Warwickshire—A new or improved tap or stop cock.—(Communication from Allen Hill, New Orleans, U.S.)

2185. William Clark, Chancery Lane—Improvements in signal apparatus applicable for the prevention of railway train collisions.—(Communication from Antoine Grivel, jun., Boulevart St Martin, Paris.)

2186. William Muller, High Holborn—Improvements in apparatus for roasting coffee, which improvements are also applicable to the roasting of cocoa and other vegetable matters.

2187. Joseph Hall, Oldham, Lancashire—Improvements in portable pumps or engines for extinguishing fires and other purposes.

2188. John Watson, Glasgow, Lanarkshire—Improvements in furnaces.

2189. Emile Alcan, Coleman Street Buildings—Improvements in machinery for carding and combing wool and other filamentous substances.—(Communication from Celestin Martin, Forge Thiry lez Verviers, Belgium.)

2190. Alphonse N. Saleres, Rue de Charonne, Paris—Improvements in printing and colouring paper, chintz, and other fabrics and machinery or apparatus for that purpose.

2191. George Knight, Foster Lane—Improvements in giving lustre to written and printed letters, figures, and devices.

2192. William Campion and Henry Johnson, Nottingham—Improvements in machinery or apparatus for cutting the selvedges or edges of knitted or other fabrics while being stitched.

3d September, 1801.

2193. Daniel Ward, Beaminster, Dorsetshire—Improved machinery for twisting and laying flax, hemp, and other fibrous materials.

2194. James Gresham, Manchester, Lancashire—Improvements in mechanism or apparatus for facilitating the stopping and starting of omnibuses and other vehicles.

2195. Edmund Suckow and Edward Habel, Oldham. Lancashire—Improvements in machinery or apparatus for producing a strong blast or current of air.

2190. Patrick Robertson, Sun Court, Cornhill—Improvements in treating yeast. and in the manufacture of ammoniacal salts and a substitute for animal charcoal.

2197. Gustav Bischof, jr., Swansea—Improvements in extracting copper and silver from ores containing those metals.—(Communication from Dr Gustav Bischof, Bonn, Prussia.)

4th September, 1861.

2198. Archibald Whyte, Great Missenden, Buckinghamshire—Apparatus for stopping railway trains.

2199. Thomas Scott, Newcastle, Down, Ireland—Improvements in the construction of roadways.

2200. Richard A. Brooman, Fleet Street—A new or improved parachute toy.—(Communication from Gustave Fautain, Paris.)

2201. William E. Newton, Chancery Lane—Improvements in self-acting brakes applicable to railway or locomotive engines and carriages.—(Communication from Léon I. Molinos, Rue St Sebastien, Paris.)

2202. Louis R. Bodmer, Thavies Inn, Holborn—Improvements in distilling apparatus.—(Communication from Edme A. Egrot, Paris.)

2203. Francois E. Schneider, Rue Gaillon, Paris—Improvements in cartridges for breech-loading fire-arms, and in the machinery for manufacturing of the same.

5th September, 1861.

2204. James K. Bayley, Thomas Harrison, William Briggs, Bolton-le-Moors, and Robert Parker, Atherton, Lancashire—Improvements in machinery for preparing and spinning cotton and other fibrous materials.

2205. Henry Young, Birmingham, Warwickshire—Improvements in counter or pillar beer engines.

2206. Robert M'Connel, Glasgow, Lanarkshire—Improvements in locks.

2207. John M. Rowan and Thomas R. Horton, Glasgow, Lanarkshire—Improvements in steam boilers and surface condensers.

2208. Charles Edkins, Birmingham, Warwickshire—Certain improvements in ladies' dress suspenders.

2209. John E. Ridges, Wolverhampton, Staffordshire, and James Barker, Birmingham, Warwickshire—Certain improvements in composite carriages for funeral and other purposes.

2210. Daniel Heyworth, Littleborough, and John Heyworth, Manchester, Lancashire—Certain improvements in looms for weaving.

2211. Peter Effertz, Manchester, Lancashire—Improvements in machinery or apparatus for making bricks, tiles, drain pipes, and other similar articles.

2212. John T. Pensam, Stamford Street, Blackfriars, Surrey—Improvements in wheels for facilitating the progress of carriages on common roads and in the means of propelling the same.

2213. Frederick Bennett, Bagillt, Flintshire—An improved method of coating the interior surface of lead and lead composition pipes with tin or its alloys.

2214. William Patey, jr., Lombard Street, and James Richardsen, Brewer Street, Clerkenwell—Improvements in the manufacture of brushes.

2215. Thomas Scott, Newcastle, Down, Ireland—Improvements in utilizing the surplus momentum of railway trains and other moving bodies, and the waste and surplus power of locomotive and other engines.

2216. John Napier, Glasgow, Lanarkshire—Improvements in the manufacture of armour plates for the protection of vessels of war, floating or other batteries.

2217. John Napier, Glasgow, Lanarkshire—Improvements in apparatus for cooling the water employed for condensing steam or other purposes.

2218. John Napier Glasgow, Lanarkshire—Improvements in machinery for rolling iron or other metals.

2219. Charles W. Harrison, Holland Grove, Brixton, Surrey—Improvements in the construction of castors.

2220. Thomas Greenwood, Leeds, Yorkshire—Improvements in machinery for sawing wood.

2221. John Reid, Leith, Mid-Lothian—Improvements in the treatment of gas, and the apparatus employed therein, with a view to its more accurate measurement in wet gas meters.

6th September, 1861.

2222. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in smoke-consuming furnaces.—(Communication from Bernard Palazot, Route d'Espagne, Bordeaux, Gironde.)

2223. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in ribbon looms.—(Communication from Messrs Benoit, Durand, and Claude Crozet, Rue de la Bourse, St Etienne, Loire.)

2224. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in obtaining and applying motive power.—(Communication from Julius Sturm (C.E.) Mannheim, Baden.)

2225. William Spence, Chancery Lane—Improvements in apparatus for dividing and softening vegetable fibres—(Communication from Felix Sorin, Rue des Fosses, Montmartre, Paris.)

2220. William Allott and John Thelwall, Hull, Yorkshire—Improvements in the manufacture of wheel tyres, hoops, and other similar articles.

2227. William Allott and John Thelwall, Hull, Yorkshire—Improvements in the manufacture of crank shafts and crank axles, and other similar articles.

2228. Edward J. Hughes, Chancery Lane—Improvements in watches.—(Communication from Adrien J. Philippe, Paris.)

2229. Charles F. Kirkman, Palace New Road, Lambeth—Improvements in obtaining manure from sewerage, and in apparatus employed therein.

2230. John J. Russell, Crown Tube Works, Wednesbury—Preparing the ends of welded tubes previous to their being fixed in plates.

2231. John Brown, Burnley, Lancaster—Certain improvements in power looms for weaving.

INVENTIONS AND PROTECTIVE PATENTS.

We are again called upon to look in the face and grapple with the oft raised question as to the policy or otherwise of affording inventive genius a secure property right and settled interest in its hardly-earned products. We are again asked to review opinions and theories as affecting this most important subject, many of them formed upon old and exploded errors, but many more got up more recently for the especial purpose of working out the present dead set which has been made against the Patent Laws, principally by parties who have been, or might have been, under due management, solidly enriched by the protecting hand which the law has always hitherto held out for the purpose. Such a person is Sir William Armstrong, the latest and most prominent advocate of the radical abolition of patents, the only source of security to which the true and honest inventor could look.

In the circumstances under which these advocates would place us, the honest inventor, in the very moment of triumph as to his conceptions, and the first blush of victory over the difficulties attending their execution, will find himself in the predicament of the labourer who is esteemed by the world to be unworthy of his hire. He will find his nights of thought and days of work to be traceless and valueless, and that all he has accomplished, of whatever value it may be to the world, is a loss to himself. Application is one of the great secrets of perfection, and as applied to the artist and man of letters, this power, combined with the natural genius of the men of these classes, furnished its own security to the fortunate possessor; but when application to such purposes as are required in mechanical, manufacturing, and chemical pursuits, leads to perfection of the plans, without in any way perfecting the fortunes of the inventor, the latter will soon yield to indolence, and give up the race. The older philosophers have told us that knowledge is power, but neither knowledge nor the available products of knowledge is of any direct value to the owner, nor any incentive to his furtherance thereof, if, the moment it issues from the crucible of his mind, he himself shall be ignored, whilst others fall in to reap where they have not sown.

The many varieties under which the human mind and human genius is constituted have all along taught us a powerful lesson as to how distinct and inevitably different are the qualities which go to make up the peculiarities appertaining, on the one hand, to the man who designs or conceives, and, on the other, to him who executes or carries out in useful practice any improvement of some real value. The whole history of invention, apart from discovery,* teaches us that, in the vast majority of instances, the designer is utterly incompetent, either from lack of the necessary peculiar genius for the purpose, or from adventitious circumstances, to convert crude ideas into satisfactory realities. Is it not then an argument vastly in favour of a sound protective system as affects inventions—that, as the matter at present stands, the designer and constructor—the latter being often almost as much a designer as the former—are equally benefited? The designer confessedly plays well into the hands of the constructor; indeed, it is to the designer that the constructor must most obviously look for work, and the means of existence. But if the inventor or designer knows before hand that the constructor will snatch all property from him under the license, as it were, of defunct patent laws, is it at all reasonable to suppose that men will be found to devote themselves to the following out of plans which may arise in their imagination, or keep themselves to the course of exertion for which alone nature has apparently designed them?

It is quite true that many men cannot avoid scheming, and the products of their brains must necessarily pass toll free into the hands of the so called practical men or constructors. And here let us take Sir Wm. Armstrong on his own ground, as his opinions afford a decent text for a short discourse on the point. Where would his splendid bonus—we do not say that it was not deserved—his salaries, his governmental titles, and his "Sir"-ship have been had he been in the defenceless condition which would obviously result from the abolition of all legislative protection of the inventor? Is it at all likely that our government would have put its hand in the nation's pockets to pay for what then would have had no money value? The result once gained, as in his case, he can afford, although at the expense, as we think, of a tremendous stretch of any reasonable moral code, to denounce the system which has been of so much value to him, or in other and more homely terms, to kick away the ladder which has been the practical means of his elevation.

Every system under which we all work has, and must have, its unavoidable evils and defects, and our protective system, as regards patents, is by no means an exception to this leading rule. But we have searched in vain amongst the remedial projects laid down by its opponents or the propounders of improvements in it, for anything like an adequate plan for superseding matters as they stand, except, as we fully admit, in points of practice. To any suggestions on this head we are well and fully prepared to listen, but we have yet to hear one single argument of value in favour of utterly cutting away the means of obtaining at least the chance of some adequate remuneration of the inventor for the time, deep thought, and, in many cases, money, which he must necessarily expend upon the subject of his investigations.

It is the business of the constructor, be he mechanical engineer, manufacturer, or working chemist, to divorce the speculative from the practical, and to make what might otherwise be a matter of empiricism, a substantial example of intellectual force—to rescue, indeed, from the masses of suggestive matter brought before him, all which his knowledge of human requirements tells him is of workable value, and which is not only good in itself, but an actual requirement of the time. In acting up to the behests of his position, he is, therefore, amply protected in such wise as to enable him to do full justice to his subject by the shield carried by the inventor. Hence, both the originator and practical developer are duly supported in their joint pursuit, so that all their solid improvements are developed and carried out under circumstances which cannot, we take it, be brought about in any other way.

To contrast the working of the Patent system with that of others wherein rewards are given, to admirable purpose, for such productions of human genius as either makes two blades of grass grow where but one grew before, or brings into existence a new blade altogether, and which had hitherto been hopelessly wished for, let us take the instance of our great agricultural prize shows. Even in our almost purely mechanical country, such gatherings are always growing larger, more attractive, and consequently always rising in abstract value. All this has been achieved by the practice of giving premiums, as well in most cases for the best mechanical appliances of the farm, as for the best specimens of the denizens which roam the fields. A vast proportion of these recognitions of merit is purely honorary; others are as substantial as the great variety and number of contending parties will allow. Now what is this most prosperous system but the Patent system under another form; but far inferior to that system, inasmuch as it does not afford any direct permanent security or reward. Yet no one finds fault with it; on the other hand, it stands in the highest favour with all in the land.

The agricultural prizeholder is recognised and rewarded simply for the time, although he certainly obtains a *prestige* which stands him in good stead, perhaps, for a lengthened period, and affords him the chance of building upon his early acquired fame. The patentee of a really useful invention is not only rewarded at the moment by the admiration and generally substantial acknowledgments of his fellow-men, but his well-earned remuneration is continued for a period long enough to enable him to realise a permanent return for all that he has done, and this at no expense to the community, as alleged by many short-sighted opponents, for the public will naturally not use a thing which is either not good or not equal in value to the price which the inventor puts upon it.

The protected inventor presents his perfected scheme to the world of customers to pick and choose as they like. He does not thrust it upon them; and it is, therefore, most surprising to see with what pertinacity some leading non-professional prints continue to urge the pointedly baseless notion, that patents not only entail compulsory expenses upon the community, but are actually obstructive and perversive as regards real improvements.

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* See Articles, "Discovery and Invention," p. 169, Vol. IV., and subsequent Parts.

"Everything that is obvious is new, and everything that is new is private property. The screw, the wheel, and the lever are all new. Don't be too forward to contradict us. If they are old in principle they are all new according to English law. One would think these were common property by this time. But no, each is the subject of some fifty patents, and if you should happen to be the happy individual who applies one of these for the first time to any new purpose, no one else can do the same without your permission. You might think that hair-brushes were articles of some long standing, but they are 'new' according to English law. One of the leading cases upon Patent law is a case about hair-brushes. Some man had cut the hairs of his brushes unequally, and claimed a right for fourteen years afterwards to make everybody else make hair-brushes with evenly cut bristles. We believe this case went off upon the important question whether a 'tapering hair-brush' sufficiently described this important invention; but the right to make all mankind cut their hair-brushes to a plane surface was never questioned.

"It is a nuisance of the most vexatious kind, is this Law of Patents. But the greatest insult to common sense is the arguments by which it is defended."

This is the recent language of England's greatest journal—on reading it, we rub our eyes to be quite certain that we read correctly—and to make sure that these most baseless of arguments are positively in black and white—"The screw, the wheel, and the lever" are "new," only as newly *combined* or *applied*, and such combination or application is most obviously the private property of the earliest combiner or applier; and, therefore, it is clear that all users ought to pay for their usage of it. A "hair-brush" *per se* is old enough, but long and short bristles duly arranged with a purpose, involved a novelty found to be of value, and consequently adopted, and, being adopted, the inventor had as clear a right to be paid for his applied sagacity and skill, as any merchant has for the wares he sells. Away with such flimsy ideas, which we cannot dignify with the name of arguments. There could not be "a greater insult to common sense," than the promulgation of such empty observations, written apparently either without thought, or the capacity to comprehend the subject—the will being used with the right hand, whilst reason is handled with the left.

THE GREAT EXHIBITION OF 1862.

The stupendous structure destined to receive the world's treasures in the forthcoming International Exhibition of 1862, is making rapid progress, each day adding perceptibly to the work completed. Since our last, we have paid a visit to this now really interesting and busy locality, and it affords us great satisfaction in being able to lay before our readers a few notes and particulars collected during our short visit. As probably most of our readers are by this time aware, the site of the building adjoins the Royal Horticultural Gardens, recently opened at South Kensington, and is a few hundred yards west of the entrance to the South Kensington Museum. The main entrance to the building, and to the principal picture gallery, is in the centre of the south side of the building, which extends along the Cromwell Road. This part of the building is of brickwork, and its upper story forms the principal picture gallery, two other auxiliary galleries being erected at the east and west ends of the same in the Exhibition and Prince Albert's Roads respectively. The principal picture gallery is 1150 feet long, 50 feet wide, and 50 feet above the ground floor, and its construction is of substantial brickwork, the walls being three feet thick. The auxiliary picture galleries are jointly 1200 feet long, and are each 25 feet wide by about 30 feet high. The lighting of these galleries will be on the principles adopted with so much success in the Sheepshanks Collection, a complete and thorough system of ventilation so important in all picture galleries being provided. The industrial buildings are constructed chiefly of iron, timber, and glass; they are rectangular in plan, with a long *annexé* appended to the north-west corner of the main building, and running along the west side of the Royal Horticultural Gardens. The main buildings and picture galleries are intended not only for the Exhibition of 1862, but for all future Exhibitions—International, Colonial, and otherwise, and therefore are of a permanent nature, whereas the machinery department, or *annexé*, which is intended for the reception of the machinery at the next year's Exhibition, is of a temporary character. On entering the industrial part of the building from the main entrance, the visitor passes under the principal picture gallery, entering a vestibule and hall 150 feet long and 110 feet wide, which leads at once to the main body of the building. This portion is divided longitudinally by a nave extending from end to end of the building, and surmounted at each extremity by a noble duodecagonal dome of vast proportions. These domes, the scaffolding for the erection of which is now ready, will be 160 feet in diameter and 250 feet high, and will be the largest ever before erected, whether in ancient or modern times. Each dome is supported on a number of hollow cylindrical columns, 2 feet in diameter and 25 feet long, bolted together by internal flanges. To give our readers an idea of the vastness of these domes, we may here mention that the dome of St Paul's Cathedral is not more than 112 feet in diameter and 215 feet high, whilst the celebrated dome of St Peter's at Rome, the largest, we think, in existence, is 158 feet in diameter and 263 feet high. Each dome springs from the intersections of the nave with two transepts, the vista from dome to dome being 1070 feet. The domes will be of glass, and will be provided with an outer and an inner gallery. A proposition, we understand, has been made to erect one of Messrs Chances's dioptric lights at the top of one of the domes, and to illuminate it at night. The nave and transepts are 100 feet high and 85 feet wide: the nave is 800 feet long, and the transepts each about 630 feet. They are lighted on both sides by clerestory windows, upwards of 25 feet in length. The roofs for the great picture galleries will be covered with slates. and will be finished, in all probability, by the time this notice is before our readers. The roofs for the nave, transepts, and *annexé* will be covered with felt, and are fast approaching completion. On the north side of the nave there will be two courts, each 250 feet by 86 feet, and a central court, 150 feet by 86 feet, and on the south side there will be two large courts, 250 feet by 200, and a central court of 150 feet square. All these courts are 50 feet high, and are lighted by glass roofs. The upper galleries, of which there is more than a mile and a half in length, enclose the courts, and extend along the sides of the nave and picture galleries. They are supported upon cast-iron columns and girders, are 25 feet from the ground, and are 50 feet wide, with the exception of those which run along the sides of the three picture galleries, which are 25 feet in width. The level of the floor of the main building is about five feet below the level of the roadway, but this apparent objection has been turned to good account, by the ingenuity of Captain Fowke. He proposes that the visitor, instead of descending at once into the building on entering, shall ascend two steps to a large platform or dais immediately under each dome, from which the descent into the building is effected by three elegant flights of steps, 80 feet wide. By this arrangement, a most picturesque *coup d'œil* will be obtained of the whole length of the nave on entering the building, from the eastern or western end. We may here mention, that all the entrances are constructed of brickwork, each to be surmounted by a tower, but we believe it is not intended to complete these towers at present, and therefore they will be roofed over in harmony with the rest of the building. The *annexé*, or machinery department, is constructed of timber, from designs furnished by Captain Fowke, and certainly this part of the structure does him infinite credit. It is of framed timber-work, without any joining, and about 915 feet in length. Part of it has three and part four aisles or arcades, each having a width of 50 feet. The roof, which is ridge and furrow, is of wood-work and glass, in about equal proportions, the whole of the light being from above. The refreshment and dining rooms will overlook the beautiful gardens of the Royal Horticultural Society, and are intended to be permanent buildings. The bricks used in the structure are from Kent, and are supplied by Messrs Smeed, of Sittingbourne. The castings are made at the Stavely Iron Works, Derbyshire, under the immediate superintendence of Mr Barrow. The nave and transepts require 166 round columns of 12 inches diameter, coupled side by side in pairs, with a corresponding number of square pillars; 312 8-inch round columns and 149 12-inch square columns are required for the galleries. The floors of the picture galleries are supported by 135 8-inch square clerestory columns, and 160 10 inch square columns, and 62 round columns will support the roofs of the glass courts, making, in the aggregate, nearly 1000 cast-iron columns. The number of girders is upwards of 1100. The Thames Iron Company supply the wrought-iron work; it is required chiefly for the great domes and roofs, and will weigh about 1200 tons. The timber work is executed by Messrs Kelk & Lucas. It is estimated that about 17,000 loads will be required. The contractors have from 800 to 900 men employed in the building, under the superintendence of their able manager, Mr Clemence. The hoisting is principally effected by steam power, two engines of eight horse power being employed for that purpose, whilst a third engine of twenty horse power is used for sawing timber.

BORING AND WINDING MACHINE.

By Mr John Paton, *Govan Bar Iron Works, Patentee.*

Illustrated by Plate 280.

The application of steam power to the mechanical operation of boring in search of minerals has been most successfully carried out by Mr John Paton, of Govan Bar Iron Works, Engineer. We had the pleasure of witnessing recently one of Mr Paton's boring and winding machines in operation at Orchard, near Glasgow, and we were greatly struck with the advantages of the new system, as compared with the tedious and laborious operation as performed by hand. And this will be at once

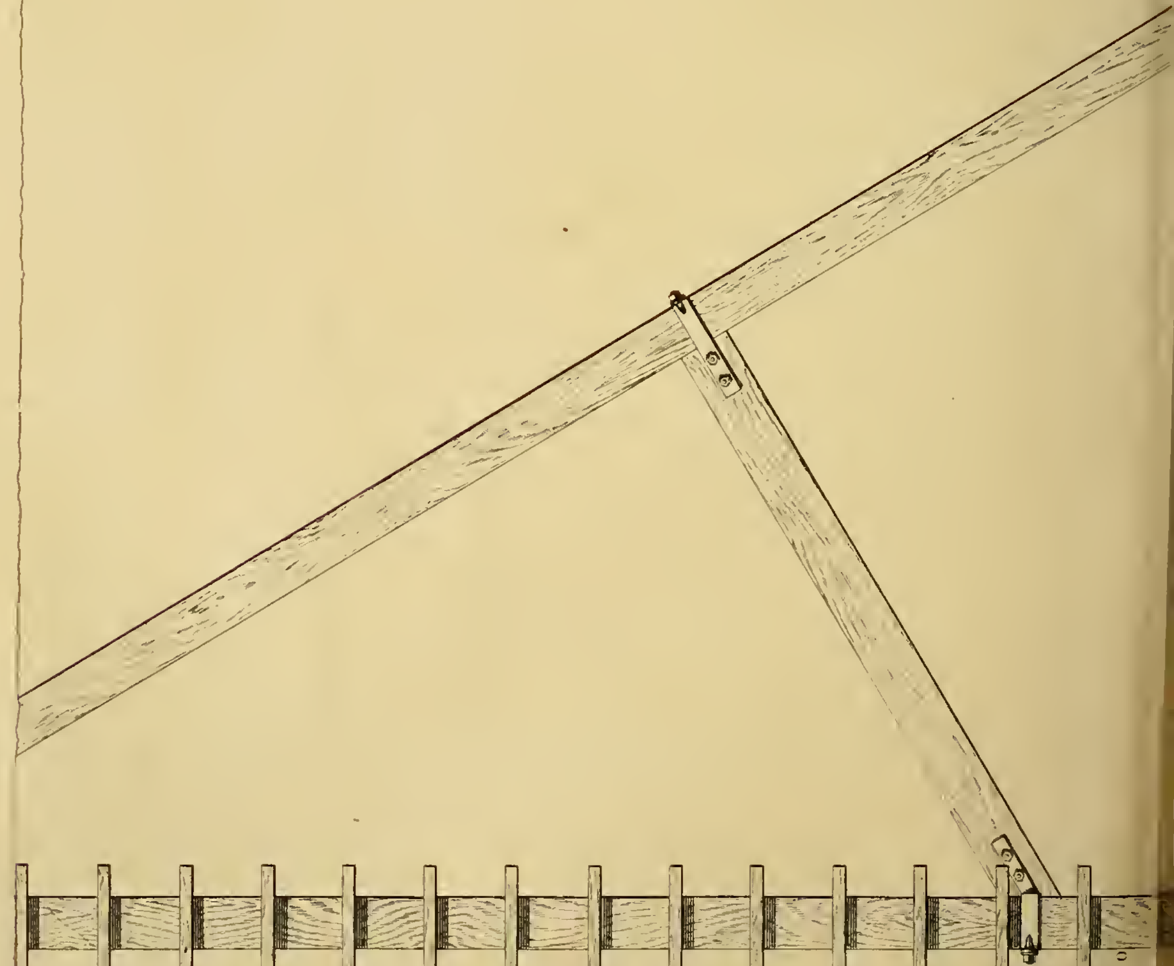


Fig. 1.

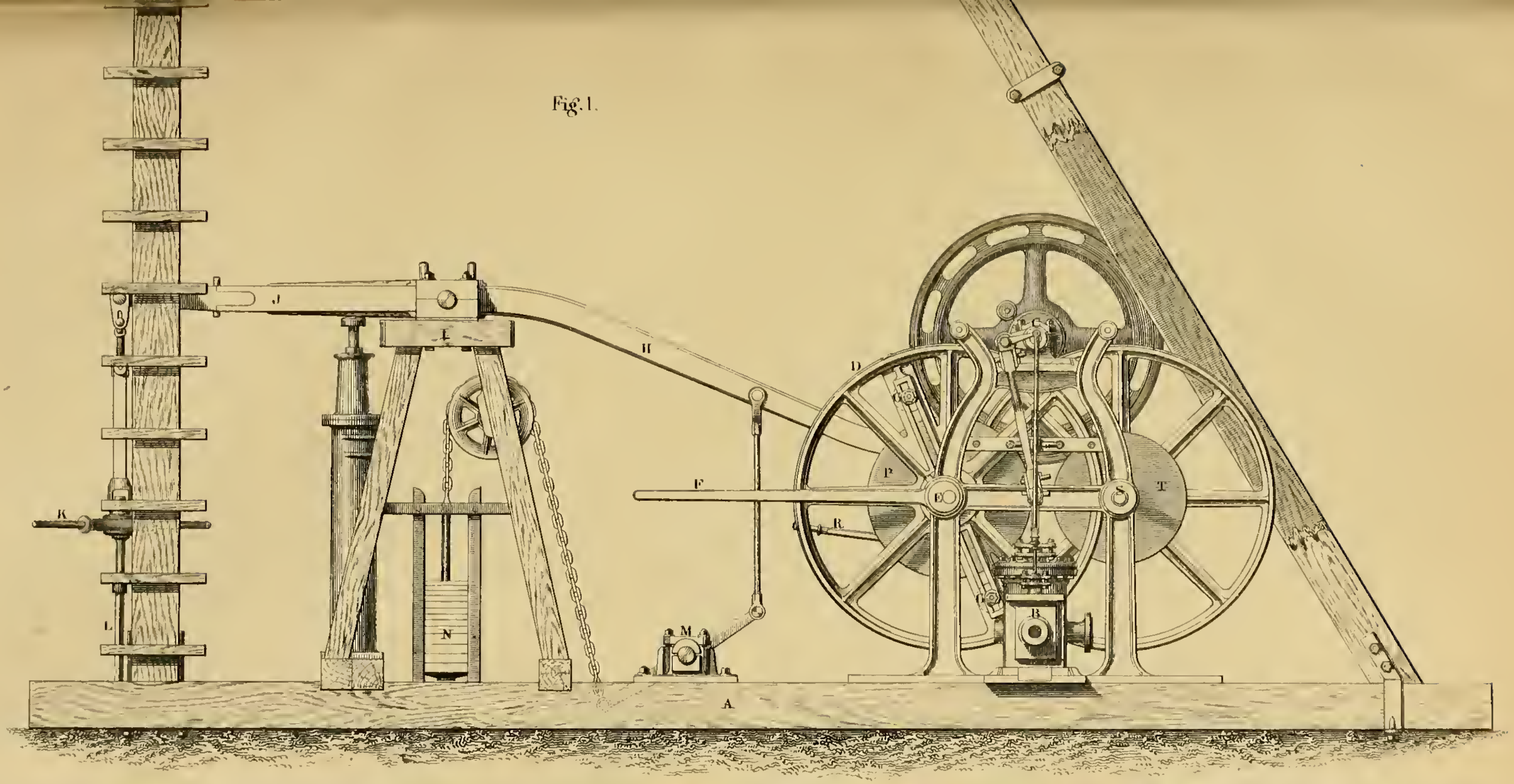
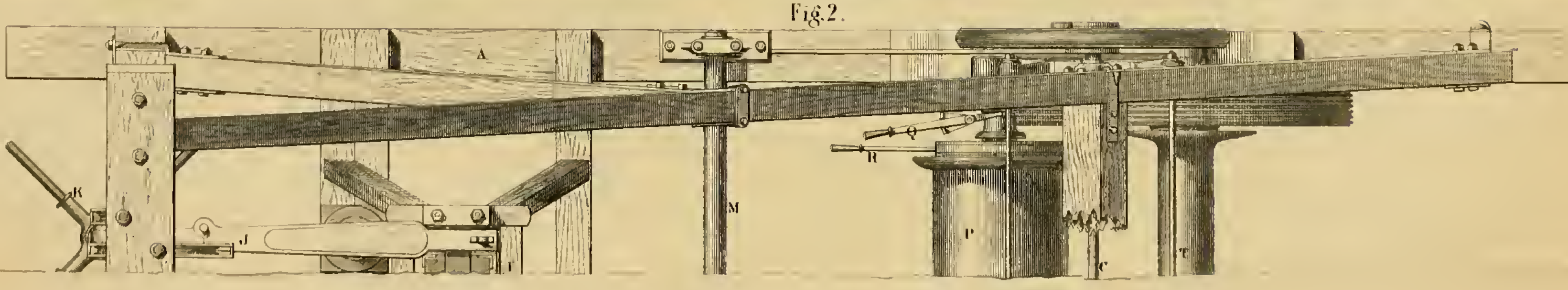


Fig. 2.



BORING & WINDING MACHINE,

JOHN PATON, ENGINEER.
GOVAN BAR IRON WORKS,
PATENTEE.

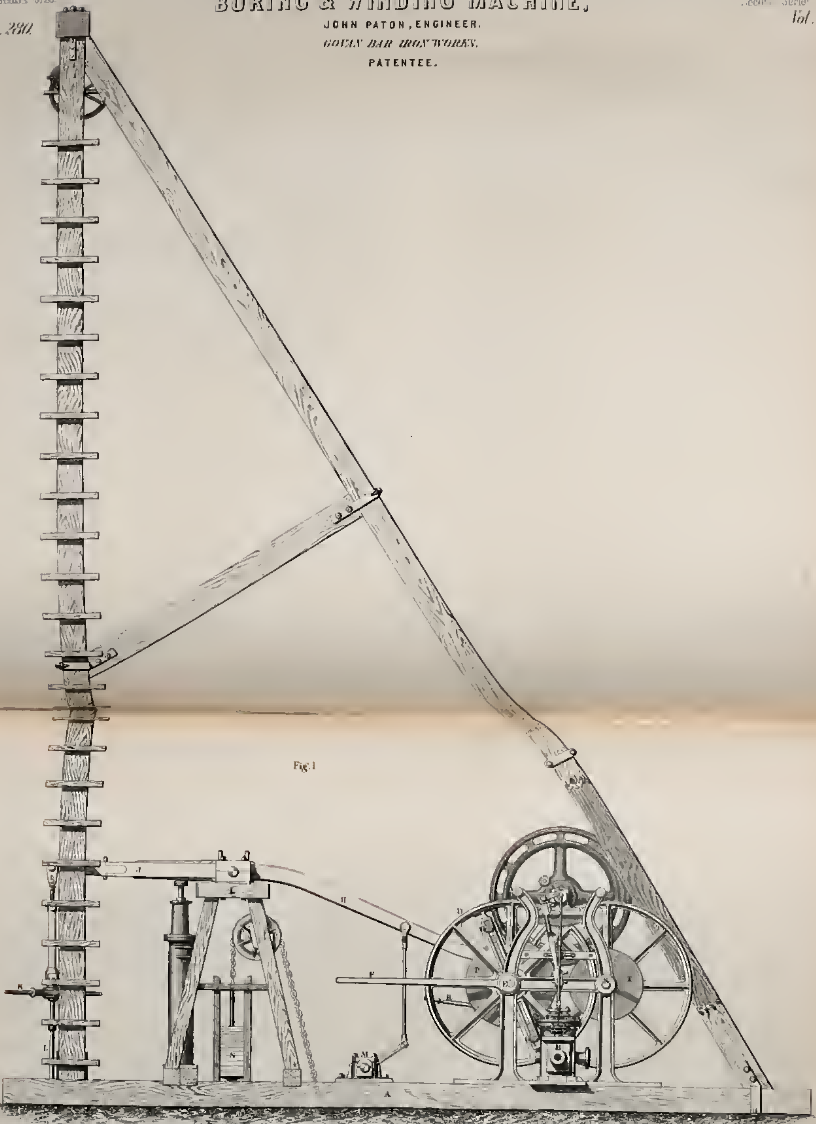


Fig. 1

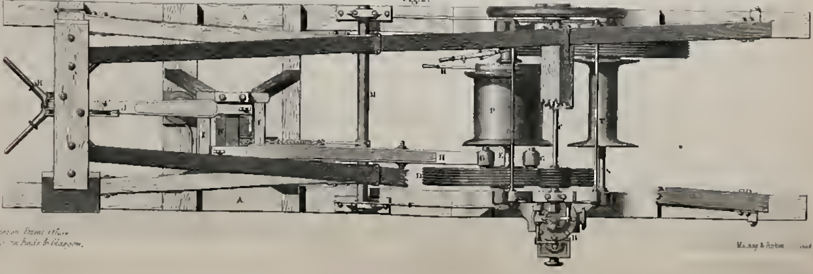


Fig. 2

[illegible] Glasgow.

[illegible]

SCALE.

INS. FEET.

evident when we state that with Mr Paton's machine the expense of boring for minerals or water is reduced to one-sixth of the usual cost. This is a plain, unvarnished statement, and one which can be proved beyond the possibility of question. The apparatus when we saw it was boring at a depth approaching 1000 feet, or nearly 150 fathoms, in the course of which the tools has passed through strata of the hardest nature. Even at this depth the rods and boring tool were lifted, and wrought with the utmost ease and without strain upon the small engine employed. The services of two men and a boy being all, or indeed more than is required, to carry on the work with speed and efficiency. The rate at which the boring is effected, as well as the extreme facility with which the rods are raised, and the pump lowered to clear the bore, enables the workmen to accomplish a very large amount of work in a given time, as compared with the old system. For example, in the bore at Orchard, which passes through a considerable extent of hard rock, the bore was carried down at the rate of four fathoms per week, being an average rate of four feet per diem. The daily progress of the work was much greater than ten or twelve men could have accomplished by hand labour alone. Useful as this machine must prove in searching for coal, ironstone, copper, or other minerals, its value would, we apprehend, be far more prominently brought out, in applying it to obtaining water in the arid districts of Australia. The portability of the machine rendering it easy of transport from place to place, the small amount of manual labour required to work it would render it one of the most valuable mechanical assistants ever introduced into the colony. To have a ready means of obtaining a supply of good water from Artesian wells on the extensive sheep runs of the colony, would be one of the greatest blessings ever conferred upon Australia. Take for example Walleroo, which promises to become as rich a field for copper as Burra Burra, there is a total want of fresh water; and the inhabitants of this young but rapidly increasing hive of human industry have only a limited supply of distilled water to use, which is sold at the rate of three halfpence per pail-full. With one of the machines we are speaking of, the lower natural reservoirs of water could be readily reached, and an abundant and never-failing supply obtained.

The accompanying plate, No. 280, represents the most recent arrangement of the apparatus. Fig. 1 is a complete side elevation of the machine, and fig. 2 is a corresponding plan. Upon the foundation frame, A, of the machine is arranged a small engine, B, which gives motion to the shaft, C. On the shaft, C, at the end nearest to the engine is fitted a pinion, which is preferred to be of the angularly grooved frictional class, this pinion imparts motion to the grooved wheel, which is keyed to the transverse shaft, E. In fitting this shaft, its journals are arranged eccentrically in the bearings, which are carried in the pillars of the framing, one of the bearings is made to project sufficiently to admit of the eye of the hand lever, F, being passed on to it, and attached thereto. With this arrangement when the hand lever is raised, the shaft, E, is lowered sufficiently to throw the wheel, D, out of gear with the pinion on the shaft, C, which comes down on a break block beneath. It is by means of the wheel, D, that the necessary vertical intermittent or jumping motion is imparted to the boring tool. In two of the arms of the wheel are formed radial slots in which are fitted the adjustable studs carrying the antifriction rollers. The studs project inwardly from the face of the wheel, D, so that as the wheel rotates the rollers alternately come into contact with and depress the end of the lever, H. This lever is fast to a short, horizontal shaft, the bearings of which are carried on the upper part of the framing, I. To the shaft is keyed a second lever, J, to the free overhanging extremity of which is suspended a swivel, and the brace head or hand wheel, K, for giving a rotatory motion to the boring rods, L, and the boring tool at the lower end of the series. The weight of the rods on the lever, H, is counteracted to the required extent by an arrangement of a counterweight used in conjunction, if required, with a hydrostatic or pneumatic cylinder. On the foundation frame are arranged the pedestal bearings of the transverse shaft, N, which has fast to it a lever connected by a chain to the counterweight. In front of the framing, I, is fitted a spring buffer apparatus which serves to modify the force of the blows, more particularly when a new boring tool is brought into use, and it is required to make the blows of the tool comparatively light. The foundation frame, A, supports the lofty frame, O, to the cross beam of which are hung two pulleys, over one of these the chain for lifting the rods, L, is passed, and over the other the wire rope for lowering and raising the pump. The arrangement of the frame, O, is to facilitate the raising of the rods, L, to save time and avoid taking the rods apart, except in lengths of thirty feet; and the frame is made of a height to admit of the rods being disconnected in such lengths. The shaft, E, has running loosely upon it the drum or barrel, P, which is put into and out of gear with the shaft by means of a coupling clutch, actuated by the hand lever, Q. This drum is used for the wire rope, for raising and lowering the pump, to afford the necessary convenience for cleansing the bore when required. The rotatory movement of the drum, P, is checked, and regulated by a friction strap, which is tightened by the handle, R. The boring rods are raised and lowered, and other winding operations performed by means of a chain wound upon a secondary barrel actuated from the first motion shaft. This shaft has upon it a second frictional pinion, which gives motion to the wheel on the shaft, S; the journals of this shaft are arranged eccentrically in their bearings as before described in referring to the shaft, E. In this way, by means of a hand lever, the wheel may be instantly put into or out of gear with the pinion. The shaft, S, has fast to it the winding barrel, T, on which the rope or chain for effecting the winding operations is wound. With these arrangements, either of the winding barrels, P or T, may be brought into operation as required, or remain quiescent whilst the wheel, D, is operating the lever, H, and the boring tool.

In boring with this apparatus, a continuous intermittent or jumping motion is imparted to the boring tool by the action of the rollers on the wheel, D, depressing the lever, H. The workman standing by the brace-head or hand-wheel, K, gives it a partial turn at each blow, so as to cause the tool to clear the rock and cut a clean round hole. In this way, and without labour, the boring tool rapidly cuts its way through the strata. When the fragments of rock or other strata accumulate and would impede the action of the tool, the rods are raised with great rapidity by means of the chain wound on the barrel, T, and they are detached in lengths of twenty-seven feet and laid upon a contiguous frame. The pump is now attached to the wire rope, and is lowered into the bore to clear out the fragments, and the boring is resumed. The whole of the operations are carried on with remarkable ease and rapidity; so much so, that no one interested in the matter would dream of continuing the use of the old system. Several of these machines have been constructed by Messrs Dixon, of Govan Bar Iron Works, which are about to be brought into active operation, and will doubtless prove as satisfactory as the one we have referred to.

GAS EXPLOSION AS A SOURCE OF MOTIVE POWER.

The giant motive power, steam, is still subject to the attacks of rival motors. It has, however, always hitherto resisted such pretentive innovatious, as our factories, railways, and steam-ships, most abundantly show. The present invention by M. Lenoir, of Paris, is of a more than usually ambitious and promising order, and it deserves some attention at the hands even of the most sanguine supporters of the steam-engine. The machinery employed by M. Lenoir is based upon the ordinary cylinder and piston movement, the piston motion being obtained by means of the difference of pressure produced on the opposite sides of the piston through the intermittent rarefaction and expansion of air au explosive gases which are injected into, and exploded in, the cylinder a each stroke.

Fig. 1.

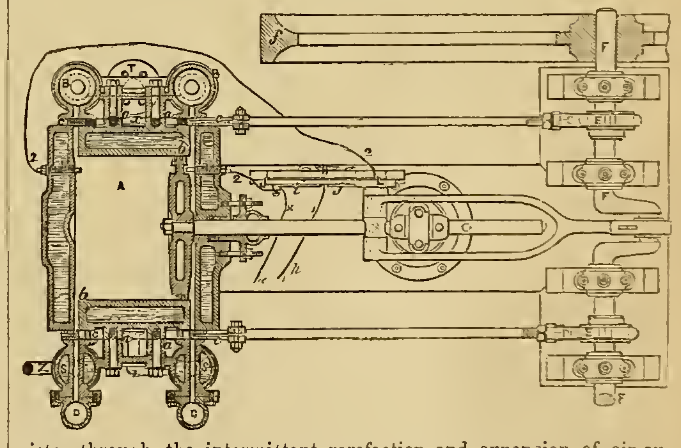


Fig. 1 of the annexed engravings represents a complete sectional plan of the improved motive power engine. Fig. 2 is a detail face view o the improved slide valve, c, to a larger scale than it is seen in hor

Fig. 2

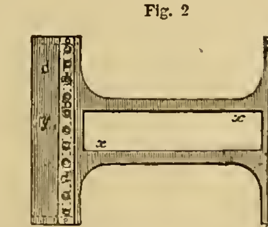


Fig. 3.

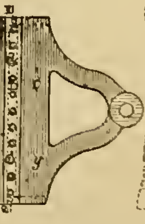
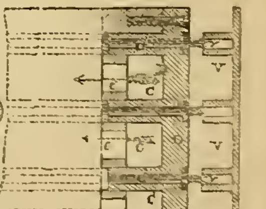


Fig. 4.



zontal section, fig. 1. Fig. 3 is a transverse section of the same taken through the small orifices through which the gas passes (along the line 1-2.) Fig. 4 is a similar section of face plate on which the valve works and conducts the gas and air in separate ducts to the interior of the cylinder. Fig. 5 is a side elevation of the bracket for carrying the screws and ends of the wires for forming the break, and connection of the electric current for the ignition of the gases. The cylinder, A, having its jacket or enveloping casing in one piece therewith, is planed accurately on opposite faces to allow the inlet and outlet slide valves, C and c, to work air-tight thereon. On the side from which the gas enters, are fitted two vessels, B, cast in one piece, and secured to the cylinder by screw bolts entering the bosses, *a*. A forked pipe, T, connected to the two lower ends of the vessels, B, supplies them with gas. These vessels communicate alternately with opposite ends of the cylinder by means of the ports, *b*. The slide valve, which works between the jacket of the cylinder and the vessels, B, distributes at the same time both the air and the gas by means of the following arrangement, shown in reference to figs. 2, 3, 4. The slide, C, which is open at *x*, to allow for the bosses, *a*, is cast with two wide rectangular cells, *y*, into which the atmospheric air enters. The gas which is supplied from the vessels or holders, B, passes through a series of small tubes or nozzles, *d*, cast in the plate, D, screwed and fitted to the slide valve, as shown in fig. 3 It will readily be seen that when the slide valve brings one of the vessels or gas holders, B, into communication with one of the ports, *b*, the gas will pass, as shown by the arrows in fig. 3, through the small tubes, *d*, without mixing with the air, which circulates round the small tubes, *d*, and enters the passage, *b* through the apertures, *e*, on that side of the valve next the cylinder, as shown by the dotted arrows in fig 3. In order that the various alternating veins of gas and of air may preserve their respective thicknesses and positions whilst entering the cylinder, the ports, *b*, are subdivided into small compartments by means of a metal comb, as shown in the transverse section at fig. 4. This comb, V, consists of a rectangular plate, provided with small metal ridges or partitions, so as to form as many channels or passages when inserted into the ports, *b*, as there are openings for the gas and air to enter therein; the smaller passages, *v*, being made to correspond and coincide with the gas inlets, *d*, passing through the valve; whilst the wider passages, V, correspond with the orifices, *e*, in the one side of the valve through which the air enters, thus effectually preventing the admixture of the air and gas in its passage to the cylinder, and so avoiding explosions when the gas is ignited by either of the igniters hereinafter more fully described. After each charge or cylinder-full, the products of combustion are distributed or allowed to escape by the slide valve, *c*, into the outlet pipes, D, which unite at their upper ends into one pipe to be conveyed away. The slide valves, C and *c*, are actuated by the eccentrics, E, keyed on to the main shaft, F, provided with one or two fly-wheels, *f*, as required. In order to prevent the undue heating of the cylinder and piston, it is proposed to establish a constant flow of cold water round and through the sides and ends of the cylinder, and round the eduction ports, which latter are also enclosed by water casings or jackets, S and *s*. The cooling water, in its circulation through these jackets, enters by the pipe, Z, into the jacket, S, and passes thence into the jacket, *s*, whence it flows by the pipe, *t*, into the lower part of the jacket round the cylinder, and finally escapes by a pipe at its upper part, which discharges it into a large tank. From this tank it is again withdrawn, after being cooled in the mass of cold water, through the pipe, S, which is in constant communication with the tank. This circulation of the water may be effected by the simple difference of temperature caused by the heat of the casings, or assisted by pumps or other simple means of circulating water. By this means an economy in water is obtained, as the same supply is made to circulate through the casings. The cylinder covers are in communication with the other water spaces round the periphery, so that the same water circulates also through them. The distributor of the electric current consists of a small metal frame or support, H, (shown also in elevation, fig. 5, detached to a rather larger scale than in the plan, fig. 1,) bolted on to the main bed plate of the engine, and having attached to it the negative wire, *h*, of what is known as Ruhmkorff's apparatus, so that the whole of the working parts of the engine, which are in direct metallic contact with each other, are charged with negative electricity. The frame, H, carries at its upper part a plate, J, insulated by caoutchouc, or some other good non-conductor, upon which are secured the two short bars, *i* and *j*, which are placed alternately, and at the proper times, in communication with the igniters, I, at each end of the cylinder, as well as with the longer bar, *k*, underneath the two short ones, and also secured to the insulating plate, J, this bar being in communication with the positive wire of the induction coil. A metal sliding stud, L, acting as a blade spring, and fixed to the crosshead of the piston-rod, travels to and fro along the entire length of the several bars, *i*, *j*, and *k*, such slide being sufficiently long to extend over both the upper and lower bars, whilst its inherent electricity serves to maintain it in metallic contact therewith, by which means the circuit is established, first through the bar, *i*, and then through the one, *j*, and *vice versa*. The break or intervening space between the contiguous ends of the bars, *i* and *j*, suffices to destroy for an instant the electric current, which is re-established at each passage of the slide, L, over the plates, and consequently the spark is produced alternately in the igniters, I, at each end of the cylinder. Fig. 6 represents in longitudinal section one of these igniters detached, and to a larger scale than shown in the plan, fig. 1 The body of the igniter consists simply of a hollow metal screw plug or bolt, *a*, having fitted into its interior a porcelain or other suitable non-conducting rod or cylinder, *b*, which contains the wires, 1 and 2. The bent wire, 1, which is in metallic contact with the bolt, *a*, is consequently negative, whilst the second wire, 2, is in connection with one of the two plates, *i* or *j*. It will thus be evident that the slide, L, establishing the electric circuit with the bars, an electric spark will be produced between the protruding points of the wires, 1 and 2. As the bed plate or base of the engine is made hollow, the Ruhmkorff apparatus, with its battery, may be enclosed therein. To start the engine, it is merely requisite to turn the main crank shaft so as to cause the piston to produce a partial vacuum behind it. The slide valve then distributes the air and gas in alternating layers behind the piston, and the circuit being established at this moment by the distribution of electricity, the spark is produced, and the ignition of the gas is effected. This causes a considerable expansion of the air, which forces the piston up to the end of the cylinder, when the fly-wheel, or wheels, overcoming the dead centre, brings back the piston towards the opposite end of the cylinder. In its return stroke the piston again produces a partial vacuum behind it, to be filled with another supply of air and gas, which is also ignited and expanded. A suitable throttle valve may be used, actuated by a governor or other regulator, whereby the supply of gas may be regulated or controlled, or the electric circuit may be broken when required by means of a commutator. Independently of the air and gas (as the principal agents in producing motion), moist steam may be used in order to assist by its expansion the action of the before-mentioned gas and air. In this case steam cocks or valves may be suitably disposed on the cylinder, one of such valves being represented in detailed vertical section at fig. 7. The steam or watery vapour is by preference collected in a receiver above the water jacket of the cylinder with which it is in communication. The water in the jacket being sufficiently heated, rises to a certain level in the receiver, whilst the steam or vapour emitted therefrom fills the upper part of the receiver, which is in communication with each of the tubes, K. The cocks or valves, R, are so mounted upon the cylinder that when the piston is at the centre of its stroke, there will be a steam-cock or vapour-valve on either side of it, so that they may come into action alternately. A small valve, *s*, closes the lower orifice of the steam inlet, being acted upon by a helical spring, *r*. By this arrangement, each time that the piston produces a partial vacuum behind it, the valve, *s*, opens and allows a certain quantity of vapour to enter the cylinder, which quantity is regulated by the position of the cock or valve on the cylinder, or by the amount of opening of the valve. The piston having made a half stroke, the spark is produced, and ignites the gas, which superheats the vapour or steam, as well as the air, the united expansion of which operates upon the piston. The two cocks or valves, R, being placed on the opposite sides of the piston, come into operation alternately. If desired, water in the form of mist or spray may be substituted for steam, the same apparatus being used. The steam and spray may, if preferred, be introduced by means of any convenient nozzle into the air inlet itself, thereby dispensing with the cocks or valves, R. We understand that more than one engine on M. Lenoir's principle have been at work in Paris, and employed daily in driving machinery. These engines have now been working for several months, and have given great satisfaction.

Fig. 5.

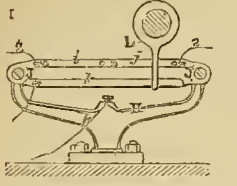


Fig. 6.

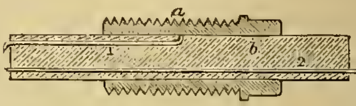
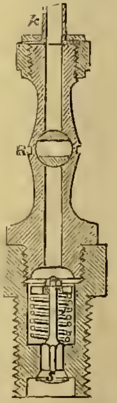


Fig. 7.



STEAM AND ITS ECONOMY.

X.

It would appear, when we begin to reason on the economy of steam, that two conditions are to be kept clearly in view, that is, extreme pressure and high expansion. To the engineer, there is no physical question so important as that of the economy of the steam engine. He is at all times anxious to learn the opinions and progress of others. He is, therefore, willing to advance; but, on inquiry from seeming authority, he learns that he must become familiar with pressures of from 300 to 600 lbs. His past experience prevents him from admitting such extremes. From that experience he learns that extreme pressures are impracticable and wasteful, and that to follow them would be no advancement in economy; for he knows that all expansions have a mean, and that, just in proportion as he exceeds that mean, the expansive energy decreases in a similar proportion to that of its increase, that is, the expansion of contraction from extreme pressure does not possess that continued amount of energy which we are accustomed to infer from such extreme pressures. It is not sufficient for him to be informed that diagrams taken, indicate a certain amount of economy, when he knows that these diagrams do not represent the full effective power; and he knows that steam of a high temperature falls most rapidly the instant that it finds space to expand in. He has, therefore, much reason to doubt the amount of economy from high temperatures and great expansion.

He is likewise informed, in his studies on the economy of the marine engine, that the water which supplies the boiler must be kept free of salt, that is, the boiler must be supplied with fresh water, and that water, after passing into vapour, must be recondensed and passed again into the boiler, to give forth energy; but he stops to inquire, will this continued re-condensation give forth the same amount of energy as when pure from the natural stream? He thinks not, because he knows that continued condensations influence the great natural laws, and that extreme temperatures change the material condition of all bodies.

In examining this question let us endeavour to keep a clear perception of fundamental principles in view, for there is no science in which it is more important that we keep these in view; and if we reason closely by these facts or principles, we will at all times be enabled to form clear ideas of the different theories advanced; so that, when heat or energy is applied to a body, we can form an idea of its effect upon that body.

First, we know that the expansive property of iron may be destroyed by overheating, and we know well that the quality of steel is entirely destroyed by overheating, so that the bar becomes a brittle mass. By the same analogy of reasoning, may we not infer that there is a degree of heat which impairs the energy of fluids. We are then to inquire, what are the changes produced on water by intense heat? From experiment, we know that the first expansion of water is the greatest, and by analogy we infer that the first expansion of the vapour gives out the greatest amount of energy. We know, then, that there is a degree of heat which impairs the energy of fluids, and that the dynamical energy of vapour or steam, when superheated to 550 degrees, becomes totally destroyed. It is also a well ascertained fact, that the pressure of steam begins to indicate a decrease when its temperature exceeds 300 deg., thus clearly indicating that economy cannot be obtained by extreme pressures. There can be no doubt that, where the steam is kept at a high pressure, cutting off early may be attended with economy, but this economy is not gained purely by what is termed expansion, but from the intense impulse which the piston receives. But where the cylinders are combined for carrying out condensation, the high pressure cylinder may receive at least three-fourths of the steam, so that its first impulse may be effective on the piston of the condensing cylinder.

In carrying out the principles of economy in the marine engine, there is one great barrier that stands in the way, that is, the supply of pure water. Many chemicals have been suggested for modifying the saline effects. A few of them, for a time, appeared to be effective; but as time passed on, they have passed with it, and have been forgotten. The supplying of the boiler by distillation is at present undergoing a fair trial, but it is only time that can decide the extent of economy to be gained from it; for it is not sufficient to be informed that 15 or 20 per cent. is to be gained by distilling, or by a constant re-condensation of pure water. We may be in possession of a certain amount of evidence to prove that economy has been gained, but when that evidence has been subjected to the test of time, that economy seems to have passed into the shade, and the economy traced to other causes. In this I am not writing from what I have heard, but what I really do know.

From practical experiments, we know that water which has for a length of time been condensed and re-condensed requires a much greater amount of heat to raise its dynamical energy to degrees of pressure than the water from the pure stream, and what we seem to gain from purifying the water seems to be absorbed in raising it to the standard of energy.

We think it may be safely affirmed, that at no period in the history of the steam engine, since it received the finishing touch of James Watt, has there been a greater desire for economy and improvement than at the present. Improvements in the harmony and design of the steam engine we have many, but in that of economy few. It would appear that the expansive experimental mind of Watt had grasped the yet apparent energies of steam, and has left but little to be discovered, and that we have reason to think he knew more than he has given expression to. James Watt made his engines to cut off at three-fourths of the stroke, and, for nearly sixty years, the firm of Bolton and Watt have made all their engines to cut off at a similar point, and have never given attention to the use of highly expanded steam.

The recent experiments made under the care of Mr Ariswood, the chief engineer of the American government, do not seem to favour the views of those who contend for high expansion. These experiments were not conducted by one only, but by a number, and they go far to prove that extreme pressures and high expansion are not on the favourable side of economy. It may be said that sufficient care was not taken to keep the cylinder as hot as possible; but we must remember that the same conditions were common to all the different experiments, and there cannot be a doubt that the committee appointed to carry out these experiments were men well qualified to note the necessary observations. At each experiment, the working of the engine was continued for 72 hours, so that full time was given for carrying out these important experimental observations, and they seem to be the most perfect set of experiments of which we are in possession, and these experiments by no means favour the theory of high expansion. We must ever bear in mind, that whatever theory or theories do not agree with fundamental principles can never advance the much desired principles of economy, and it seems clear that the economy of the marine engine is not to be gained by extreme pressures or high expansion.

We are in possession of the amount of economy of high pressed steam as applied to the locomotive, but the conditions of the marine engine are so different that there is no comparable analogy, so that the same process of reasoning cannot be applied to both, so long as the primary conditions remain the same as they are. The great desire to carry out the principles of economy in the marine engine has impelled us forward, and our desires, being stronger than our practical experience, may have induced us to look for economy where it cannot be found; and when we begin to reflect calmly on our experience, we feel surprised that we have departed so far from fundamental principles. Paul Cameron.

DR THOMAS YOUNG.

Dr Thomas Young was born the 13th June, 1773, at Milverton, in Somersetshire, of Quaker parents. Precocity displayed itself at once, for at two years of age he was able to read with considerable fluency, and before five he could repeat the whole of Goldsmith's Deserted Village, which he had voluntarily committed to memory. Before he was six he had begun to study Latin; and ere he had completed his thirteenth year, we find this wonderful boy had read several Latin and Greek books, had commenced the study of Hebrew and Italian, and had studied books on arithmetic, mathematics, and natural philosophy. He had also learned the use of the turning lathe, the quadrant, the electrical machine, and other instruments; had made telescopes and a microscope, rude instruments of course; and had acquired the art of drawing. In very much of this he may be considered as self-taught, for the schools he was sent to by his father (who does not seem to have given himself much trouble in furthering the boy's education) were of a poor description. However, his industry and acquirements had not been unnoticed. By a series of accidents he was introduced, when about fourteen, to Mr David Barclay of Youngsbury, Hertfordshire, and became the instructor in classical literature of that gentleman's grandson, a boy not much more than a year younger than his tutor. He remained five years at Youngsbury, pursuing his studies with ardour, and fulfilling his duties to his pupil to the satisfaction of all. He was accustomed to consider this period as the most profitable one of his life, both as respected mental and moral cultivation and improvement. He rendered himself a good classical scholar, and prosecuted an acquaintance with Oriental languages. His notebooks contain extracts from books in twelve languages, exclusive of English; and there is a story told of him, that when some one, presuming upon his youthful appearance, asked him to produce a specimen of his handwriting, he exhibited a sentence beautifully written in fourteen languages. Moreover, he studied books on mathematics, natural philosophy, and natural history. It is, however, to be particularly observed, that the books he read were not many in number, nor superficially examined. What he undertook, he went through with; and he attributed much of his success in after life, as a scholar and a man of science, to the early-formed habit of subjecting every book he perused to a deliberate and careful study. As a means of mastering a language, he was accustomed to make compositions in it, and with this view his commentaries on Latin, French, and Italian authors were written in their languages. Into Greek he made some excellent translations of passages in Shakspere, some of which attracted the attention of Edmund Burke, Dr Charles Burney, and others, for their accuracy and elegance. By this time he had formed a beautiful style of writing Greek characters.

In these early years he sometimes passed a few months in London, at the house of his great-uncle, Dr Brocklesly, an eminent physician, by whom he was introduced to the best literary society of the time. In the summer of 1792 he finally quitted Youngsbury, and having determined upon entering the medical profession, he went to reside in London, for the purpose of attending lectures and prosecuting his studies. His great-uncle had now undertaken the charge of his education, and through him he had access to the most distinguished literary circles. He still outwardly adhered to the Society of Friends, though he had really abandoned many of their peculiar tenets. Under the advice of Mr Burke, he undertook the systematic study of the works of Cicero. His manners were quiet and pleasing, whilst his conversation on classical and scientific subjects is said to have exhibited a confidence and precision far beyond his years. In 1793, whilst pursuing his professional studies, he wrote a memoir, which was laid before the Royal Society, on the structure of the eye, particularly with reference to the means by which it is adjusted to the perception of objects placed at different distances. His explanation was that the crystalline lens is acted on by muscular fibres. On the appearance of this memoir, the celebrated anatomist, John Hunter, laid claim to the alleged discovery, and it was rumoured that Young had obtained his ideas indirectly from Hunter himself. The rumour, however, was shown to be without foundation. This seems to have been the first of the occasions which, in course of time, unluckily for Young, became numerous, when it was attempted to deprive him of the merit of priority or originality. Soon after attaining the age of 21 years, he was offered the appointment of private secretary to the Duke of Richmond, which he declined, having determined to go on with his medical education, although Burke and others advised him to turn his attention to the law.

After making tours in different parts of England and Scotland, and passing two sessions as a medical student at the University of Edinburgh, during which time he entered largely into society, read some of the Italian, Spanish, and German classics, and as his Quakerism gradually melted away, took lessons in the vanities of music and dancing, he proceeded, in 1795, to Göttingen, where he matriculated at the university as a medical student. Here he spent his time in attending lectures, studying books on medicine, anatomy, natural history, physics, &c., and prosecuting an acquaintance with the accomplishments of drawing, music, dancing, and equitation. After taking his degree of M.D., he spent some months in visiting various parts of Germany, and arrived in England early in 1797. Soon afterwards, he was admitted a Fellow-Commoner of Emmanuel College, Cambridge. Whilst there, he impressed all with whom he came into contact with the power of his intellect and the extent of his attainments. And yet it is said that his room had all the appearance of belonging to an idle man, for there were no books piled on the floor, no papers scattered on his table. He entered much into society, and acquired the friendship of many distinguished people. At the close of the same year Young lost his uncle, and came into possession of a house in London, a good library, a choice collection of pictures, and £10,000. In January, 1800, Young laid before the Royal Society a memoir, entitled "Outlines and Experiments respecting Sound and Light," containing matter of great theoretical importance. In the same year he published, in a magazine, nine essays on scientific subjects, in one of which he referred to a young gentleman in Edinburgh, who, in a memoir printed in the "Philosophical Tranactions for 1798," had proposed one problem as new which was familiar to the mathematicians of the seventeenth century; and had put forward a solution of another problem as superior to one given by Newton, whilst in reality it was less simple. He had, moreover, given an erroneous name to a curve. The young man in question was the present Lord Brougham, who, we may be sure, seized the first opportunity for retaliating, and who, we hope, has long been ashamed of the violent abuse which he poured, without stint, on Young's valuable memoirs, the more so as the articles in the *Edinburgh Review* had the unfortunate result of diverting scientific men from the consideration of these memoirs. In 1801 Young first publicly announced his ideas as to the propagation of light by undulations, having been led to extend the principle of interferences from sound to light. "This discovery," says Sir John Herschel, "would alone have sufficed to place its author in the highest rank of scientific immortality, even were his other almost innumerable claims to such a distinction disregarded." Three memoirs on Light and Colours followed, and formed the first great epoch in the history of his optical discoveries. Their great fault is obscurity; and this was brought about partly by his love of condensation, partly by his employing ordinary language, instead of using those forms of demonstration—whether geometrical or symbolical—which convey clear ideas to the minds of scientific men, and by which correct conceptions of abstruse questions in physics can alone be communicated Their real value remained undiscovered at home until Arago and Fresnel expounded and illustrated them. In the course of 1801 Young was appointed Professor of Natural Philosophy at the Royal Institution—an office which he held for two years, and then resigned, in the belief that his prospects as a practising physician would be injured by the retention of it. During the greater part of this time he undertook to conduct the Journal of the institution along with Davy. At the beginning of the following year he began a course of lectures, and the next year another course. These lectures were marked by extreme condensation, and it is said they must have been generally unintelligible, even to well-prepared persons. In 1802 he accepted the Foreign Secretaryship of the Royal Society, which he retained for the rest of his life. On resigning his professorship, he began to prepare his lectures for the printer, with the addition of a catalogue of the works which had previously appeared on the subjects treated of. This task occupied him for four or five years. They were published in 1807, along with a reprint of various scientific memoirs. The two quarto volumes occupied 1500 pages, and were illustrated by 40 plates, which contained nearly 600 figures, maps, &c , which he had himself drawn. A very comprehensive system of Physics was here developed, "equally remarkable," says Dr Peacock, "for precision and accuracy in the enunciation of the vast multitude of propositions and facts which they contain, for the boldness with which they enter upon the discussion of the most abstruse and difficult subjects, and for the addition or suggestion of new matter, or new views, in almost every department of philosophy. The lectures on the passive strength and elasticity of materials; on the sources and effects of sound; on the essential properties of matter; on the sources, the effects, the measures, and the nature of heat; on electricity in equilibrium and in motion; and on climates; are full of original and instructive speculations, which were, in many cases, greatly in advance of the knowledge of the age in which they were written." The same authority speaks of his lectures on the cohesion of fluids as amongst the most original and important of the contributions which he made to physical science.

In June, 1804, Young took a wife. The lady was Eliza, one of the daughters of J. P. Maxwell, Esq., of Cavendish Square. She was much younger than her husband, but the marriage proved a very happy one; and it is to the perseverance of this lady that we are indebted for having induced Dr Peacock to undertake the excellent biography of Dr Young, from which this sketch has derived its facts. He now determined to devote himself entirely to his profession. He still found time, however, to write several scientific memoirs anonymously. At this period of his life, besides delivering two courses of lectures on chemistry, physiology, and medicine, he wrote some books and several memoirs on topics connected with his profession In 1811 he was elected one of the physicians to St George's Hospital, the duties of which he conscientiously performed. Amongst the members of his own profession, as well as amongst the sick public, he appears never to have been popular. There has always been a prejudice, in all professions, against any one who engages in alien pursuits. The practice of that day was much more empirical than it now is, whilst Dr Young's aim was to discover principles, and found upon them rules of practice. Moreover, in his intercourse with his patients, he employed none of those pleasing, and perfectly justifiable arts, by which many physicians are wont to recommend themselves. For these reasons, it happened that, notwithstanding his great ability, he failed to secure much practice. It ought, however, to be observed, that the apothecary of the hospital remarked that a greater proportion of the patients admitted under Dr Young were discharged relieved, than of those subjected to the treatment of the other physicians.

It is not our intention to notice at any length Dr Young's labours on philological subjects, those on Greek manuscripts, and the still more weighty ones on Egyptian hieroglyphics. It is to us a subject of deep regret that he should have expended so many years of toil on matters so comparatively barren and unimportant as these, toil which, if it had been directed to physical science, would, in all probability, have resulted in discoveries of the highest interest and value. His researches showed, indeed, his acumen, learning, and perseverance in a striking light; but how much better would it have been for the world if the subjects to which these qualities were directed had been important and not merely curious, leading to the announcement of new principles and facts, and not merely making us wonder at the powers of the investigator! To those who thirst after the fruitful truths of nature, Young's application of his great abilities to these topics must appear much more than waste of time. Between the years 1816 and 1823, Young contributed forty-six biographical articles, and seventeen scientific articles, to a Supplement to the "Encyclopædia Britannica." Of the latter we are told that they are hardly surpassed in originality and importance by any works on the same subjects which have appeared in modern times.

When Mr Seppings, a master shipwright in Chatham Dockyard, brought forward various alterations in the mode of building ships with a view to increase their power of resisting strains, the matter excited so much controversy that the Admiralty thought it right to consult men of science as to the value of the proposed changes. Dr Young, amongst others, was requested to inquire into the subject; and after making careful investigation, he wrote a report, the substance of which was embodied in a memoir read before the Royal Society in 1814. His decision was greatly in favour of Mr Seppings' propositions; at the same time, he displeased that shipwright's friends by pointing out certain defects. In 1816 Young was appointed secretary to a commission for ascertaining the length of the second pendulum, for comparing the English with the French standards, and for inquiring whether a more uniform system of weights and measures might not be advantageously adopted. Three reports were drawn up by Dr Young in 1819, and the two following years. It finally appeared, with regard to the length of the pendulum, that when supposed to be oscillated, in vacuo, at the level of the sea, in the latitude of London, when the temperature of the air and its mass was 62° F, a length of 39·13929 inches ought to be assigned to it. It has, however, been abundantly shown that the theoretical corrections applied by Captain Kater to the reduction of his observations were erroneous. The value of the correction previously assigned was too great, and Young proved that the pendulum ought to be increased in length by about seven ten-thousandths of an inch.

At the period when it was first proposed to employ coal gas as a means of illuminating towns, an explosion of a gas-seasoning house occurred, which induced a belief that gas was too dangerous to be used for this purpose. Young was a member of a committee of the Royal Society to inquire how far this belief was correct. The chemical part of the inquiry was undertaken by others. Young directed his attention to the explosive force of coal gas when mixed with atmospheric air, which he estimated at less than the one-thousandth part of that of gunpowder, mass for mass. In 1818 he was appointed superintendent of the "Nautical Almanac," and secretary of the Board of Longitude, with a salary of £400 for the two offices. This appointment showed the high opinion generally entertained of his powers, for he had never specially applied himself to the study of astronomy. Nevertheless we are told that he discharged the duties imposed upon him as if the science had formed the chief business of his life. Various suggestions were made by the astronomers of the day as to improving the "Nautical Almanac" by extending its scope, so as to render it useful to astronomers as well as to navigators. Young obstinately resisted all change, and thus became involved in an acrimonious controversy, which only terminated with his death. The Almanac was shortly after that event entirely re-organized, and it then took the form in which we now see it. It must be admitted that Young was greatly in error in not at once adopting the suggestions which were put forward, instead of giving way to personal considerations, and standing in the way of improvements. He was also mixed up in another acrimonious controversy with Mr Ivory, on the subject of atmospheric refraction, in which it is generally thought that Young was in the right. It is much to be lamented that scientific questions should give rise to disputes of this nature, but we must expect their occurrence as long as human nature is what it is.

We now arrive at the second epoch of Young's optical investigations. In France, several inquirers, Malus, Biot, Arago, and Fresnel, had been pursuing, with brilliant success, the examination of various optical phenomena, especially those connected with polarization and the colours thereby produced; but they all failed to give a satisfactory theoretical explanation of these phenomena. Young, on reflecting upon the new discoveries, and attempting to explain them from the point of view of the doctrine of undulations, suggested that the vibrations which gave rise to the phenomena of polarization were transverse to the direction of their propagation, an idea which had flashed across the minds of some of the French philosophers, but which appeared to them too paradoxical to be put forward. It was no sooner suggested by Young than it was seen by the unprejudiced that polarization must be connected with transversal vibrations, inasmuch as its phenomena were otherwise inexplicable; and further, that the phenomena of double refraction were connected with the direction of the greatest and least refractive densities of a doubly refracting crystals, and this again with polarization. We must regret that Young did not follow up his inquiries, which must have soon led him to the fact that in biaxal crystals both of the refracted rays are extraordinary. This discovery was reserved for Fresnel, whose splendid career was too soon to be stopped by death. Young, however, went on to inquire into the phenomena of the colours produced in certain crystallized plates by the action of polarized light. Here he demonstrated that these colours proceeded from the difference of the velocity of transmission of the ordinary and extraordinary rays. Fresnel then explained why the interference of the two rays produced no colours unless the emergent light was sent to the eye through a plate of Iceland spar, or by some other polarizing substance. Sir John Herschel, in reviewing these theoretical discoveries, assigns to Young the merit of early, acute, and pregnant suggestion; to Fresnel that of maturity of thought, fulness of systematic development, and decisive experimental illustration.

In the summer of 1821, Dr and Mrs Young spent some months on the continent, visiting Rome and other parts of Italy. In the following year he went to Paris, where Champollion, the investigator of Egyptian hieroglyphics, was introduced to him by Arago. In the summer of 1824, he spent two months at Spa with Mrs Young; and in that year he was appointed by the Palladium Insurance Company their inspector of calculations and medical referee, with a salary of £500 a-year, which, however, was reduced, at his own instance, to £400, on his finding that the work was less than he had expected. When holding these appointments, he studied the methods for calculating the value of life under various circumstances, and he proposed new formulæ for expressing that value in several essays which he wrote.

As to Young's memoirs and articles on hydraulics, bridges, carpentry, trades, etc., we must content ourselves with remarking that most of them display his accustomed sagacity and philosophical power. He himself regarded the essay on the Theory of the Tides as nearly the most original and successful of his physico-mathematical investigations; and Dr Peacock has said of it, that notwithstanding the mathematical skill, and clearness and completeness of exposition, which characterize Professor Airy's later memoir on Tides and Waves, there are not many of his results which Young had not previously obtained, though in a much less definite form, by a novel and ingenious conception, by which he deduced conclusions that had evaded the laborious researches of Laplace, the greatest of modern writers on the mechanism of the universe.

In 1827 he received the honour of being elected one of the eight Foreign Associates of the Academy of Sciences at Paris; and in the following year he took his seat in that assembly on the occasion of his paying his last visit to the continent. Symptoms of decaying strength manifested themselves during this journey, but he lingered until the 10th of May, 1829, when he died in London, in the fifty-sixth year of his age, the complaint which carried him off being ossification of the aorta. He left no children, but we believe his widow is still living. He had spent the greater part of the year in London, but for several years in the middle of his life he lived for the summer months at Worthing, where he built a house. After perusing this sketch of his scientific investigations, it may surprise some of our readers to learn that he entered largely into general society, and that he enjoyed its amusements with a relish which might seem to belong to the idle alone, being always ready to join in a dance or a glee, or to take part in any plan for adding to the pleasures of the company. His manners were polished, his conversation animated, and he was always welcomed by the cultivated and the intelligent. The more we contemplate Young's career, the more are we led to admire the profundity and variety of his mind, and the extent of his acquirements. His was one of that class of genius that makes the generality of mankind ashamed of their ignorance and dulness. We must, however, count it a misfortune that he continued to pursue the profession of a physician after he had ascertained his capacity for purely scientific inquiries. If he had not put restrictions upon his investigations, if he had devoted himself entirely to science, what a name might he not have acquired! As it is, he has left the ineffaceable impress of his powers on the subjects which he took in hand, and his name will ever be honourably mentioned amongst the most successful cultivators of science.

Unfortunate as Young frequently was in having the priority of his discoveries disputed, he has at least been fortunate in his biographer. Dr Peacock was a man well acquainted with many of the subjects he had to pass under review. His work has been thoroughly well done, and the result is a model biography, and a book of permanent value.

RECENT PATENTS.

STEAM BOILERS.

James Bremner, *Glasgow.—Patent dated March* 28, 1861.

This invention relates more particularly to improvements in steam boilers of the horizontal and vertical tubular class.

Fig. 1 of the accompanying engravings is a half front and half sectional elevation of one modification of the improved steam boiler. This boiler is symmetrical on each side of the centre line, 1—1, that part of this figure to the right of the line, 1, is a front elevation of one half of the boiler, and that to the left is a sectional elevation taken through the centre of the boiler, furnace, and chimney. The base or lower part of this boiler is of a square or rectangular form, in horizontal section, with rounded corners, and is arranged with two furnaces, A, in the width, formed of double lengths of fire bars running from the front plate, B, to the back, C, but having one common ash-pit, *a*. These fire grates, A, have each a furnace door, *b*, passing through the water space in the front, B, of the boiler, which admits of charging or firing the furnaces alternately for the better burning of the gaseous products of combustion. The smoke evolved from the fresh fuel meets the flame of the other fire, and is ignited at the bridge, which divides the two fires. All round this rectangular basement, or combined double furnace, there is formed by the outer sides, B, C, and D, and an inner shell or casing, E, an outer water and steam space, F. This water space begins close to the level of the furnace bars, and at the front and back extends upwards in a vertical and parallel direction to above the height of the tubes, at the sides this space is considerably enlarged over the furnace, and bulges outwards in a curved or crescent form as it extends upwards; the inner and outer casings are contracted gradually all round from about the water level in the form of a dome till they are joined at the crown, G, leaving a circular aperture to receive the chimney, H, as shown in the section on the left of fig. 1. A water space, I, is also formed in the centre of the boiler between the two furnaces by an inside casing or duct, J, running between the back and front inner shells, E, and joining the water space, F, of these two sides. The sides of this water recess, J, are of a pear-shaped figure, in transverse vertical section, and are parallel to each other in horizontal section. This water compartment consequently divides the large space over the furnaces into two large rectangular segmental flues, K, which conduct the flame and gases of combustion up the two sides of the boiler, and they intermix with each other at the crown, G, just before entering the chimney, H. Across these two rectangular flues, K, are arranged a series of tubes, *c*, in rows in the horizontal section, but radiating as nearly as possible at right angles in the vertical section to the curved surfaces of the two inner shells, E and J, of the boiler which form the tube plates for the ends of the whole series of tubes. The lower rows of tubes are so arranged that the spaces between them are wider than those above so as to allow the flame easier access to the upper tubes. The flame from each furnace passes up the flues, K, and impinges on each row in succession until it reaches the top row, where it acts upon the arched dome, E, or if it is not desired to superheat the steam, or act upon the part of the boiler which contains the steam above the water, the two surfaces, E and J, at this part may be lined with fire-clay bricks, supported on angle iron, as indicated by the dotted lines at L. In the centre of the two sides, D, and front, B, is formed an improved man-hole door, M, having a rim or raised lip projecting inwards, which enters a corresponding recess formed in the cover or door. This recess serves to contain gasket or other packing. These doors are arranged near the ends of the tubes in the two water spaces, F and I, the space, I, being made large enough for the withdrawal of old, or the introduction of new, tubes. At the rounded corners of the lower part of the outer water space, F, are fitted sludge-hole doors, N, constructed in the same manner as the man-hole doors, M. The two furnaces, A, are divided longitudinally by a combined feed-chest and air-supply bridge, O and P, which stands considerably higher than the fire, and extends from the front, B, to the back C, of the boiler. The lower part, O, which is rectangular, receives the water direct from the feed pumps at the one end, and from the other it passes into the boiler. The under side of this bridge or feed water chamber, O, is made in the form of an inverted cover, with flanges and bolts, so as to be removed at pleasure for the purpose of cleaning out any sludge or sediment which may collect at this part. The top part, P, of this duplex bridge is arched at the top and partitioned off some little distance from the top by a double flanged horizontal plate from that portion, O, which forms the feed water chamber. In a line with the arched part, P, at the top of the bridge, which forms a semicircular air tube or duct extending from the front to the back water spaces, F, there are two tubes passing through these water spaces, which admit a free ingress of atmospheric air at one or both ends to the chamber, P. The passages of these tubes may be controlled by valves so as to regulate the supply of air to the two furnaces. The air which enters the tubes, after being heated in the chamber, P, passes through elongated narrow slits formed in the crown of the chamber, as shown and indicated by the arrows in fig. 1. This arrangement of boiler is of the horizontal tubular class, inasmuch as the tubes, *c*, lie in a nearly horizontal position, and gradually diverge towards the bottom, so that the currents of flame and heated gases, after impinging on the radial lower rows, pass upwards to heat the top rows. The current of heated water, and the steam as generated, pass upwards through the tubes in a slanting direction to the central space, I, and down the back and front spaces, F, thereby keeping up a continual and regular circulation of the water through the boiler. Boilers arranged upon this principle of construction are economical in first cost; they are easily accessible in all parts, and they generate steam with great rapidity and economy of fuel. Fig. 2 of the accompanying engravings is a similar half front elevation and vertical section to fig. 1 of another modification of these improvements as arranged and applied to vertical tubular boilers. In this arrangement of boiler the lower part is constructed very similar to the first modification. The furnace, A, is duplex, the ash-pits, *a*, having doors in front to admit air below the fire bars or not as desired. The two fire-grates, A, are in this instance formed by three lengths of bars, and are separated by a duplex air and water feed chamber, perforated and arranged with tubes passing through the front and back water spaces, F, as in the first modification, and having sludge-hole doors, N, at the four corners of the lower part of these water spaces. The back and front water spaces, F, extend up from the furnace in a vertical direction till they merge into the large water and steam space, I, above the upper tube plates. The inner shells, or sides, E, of the side water spaces are each carried inwards in the form of an arch, which extends well over the fire grate immediately below it, and is then turned upwards and riveted to a flat tube, plate E^1. This plate lies at a slight angle, inclined upwards, and extends outwards to meet the outer shell, D, which is carried up until it meets the outer plate and is riveted to it, thus enclosing a water space, F^1, over each furnace, which space extends from the front to the back water spaces. The top or crown of the boiler is arched over at D^1, and riveted to the outer shell of the front and back at B^1 and C^1, which are bulged slightly outwards at this part. To the lower ends of this arch, D^1, and to a central longitudinal stay, *d*, is firmly riveted the upper tube plates, *e*, lying parallel to the lower tube plates, E^1. These two pairs of upper and lower tube plates, *c*, and E^1, enclose two flue spaces, K, diverging to the right and left into smoke boxes, *f*, and from this upwards into two flues, *g*, carried round the arched crown, D^1, of the boiler to the foot of the chimney, H. The smoke boxes are enclosed at the back and front ends by a plate projecting from the body of the boiler in a line with the inner lining, E, and at the sides by double lined doors for the purpose of getting at the tubes, *c*, to clean them. The tubes, *c*, are ranged in a nearly vertical manner at right angles to their tube plates, and in parallel rows, filling the whole space enclosed by the flue, K. The outer covering of the flue, *g*, above the smoke doors, *h*, is formed of a double casing of boiler plate enclosing a superheating steam space, *i*, supported or attached to the top of the boiler by the brackets, *j*. The arched portion, D^1, of the boiler which forms the steam space, I, is made large enough for the withdrawal or introduction of the tubes, *c*, and is fitted with a pipe for conveying the steam from this part to the superheating chamber, *i*, from whence the steam is conveyed by a suitable eduction pipe. A man-hole door, M, is formed in the crown, D, at the lower part of the chimney, and another opening into the water spaces, F^1, over the fire-places for the purpose of making the end joints of the tubes. These doors are formed by riveting a ring of angle iron all round the hole in the shell of the boiler, and allowing the edge ring or lip, *k*, to project inwards and fit into a recess formed in a cast-iron cover, *l*, which is screwed up tight by two cross-bars and four bolts on the outside, gasket, or other suitable substance for

Fig. 1.

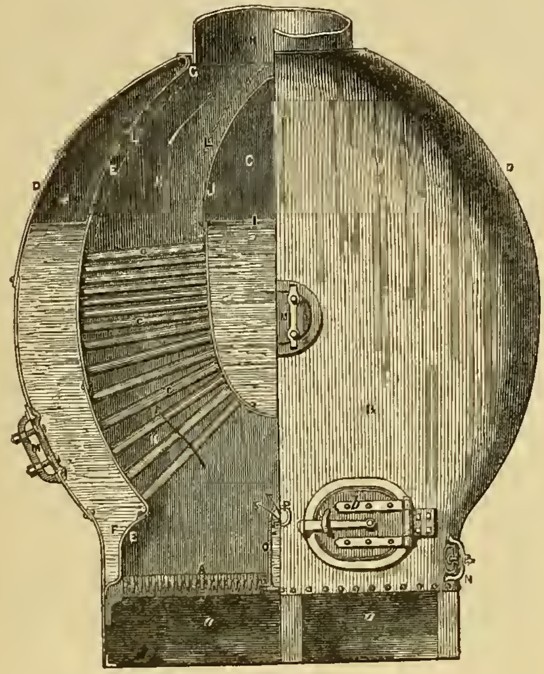
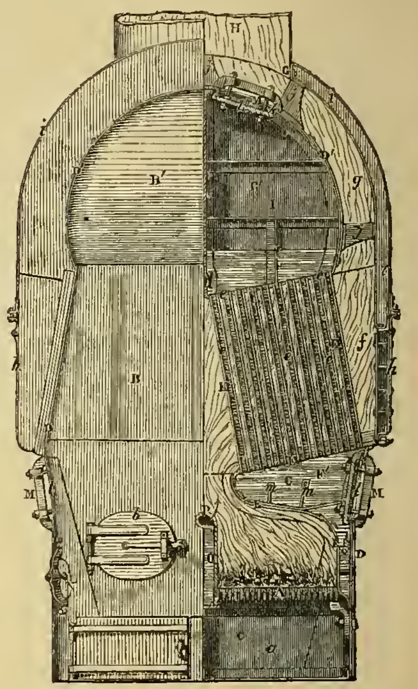


Fig. 2.



forming the joint, is inserted in the groove of the cover, *l*, before screwing it up. The lower portion or side of the water space, F^1, is firmly secured at the arched part over the furnace by malleable iron stays, *m*, to the sides, D, and back and front end plates, B and C. The imitation of a fire indicates the direction of the flame and gases of combustion in this figure, and large arrow in that of fig. 1. These products of combustion pass from the two fire places, and are carried over the top of the bridge at P, where the heated air is supplied which mixes with and ignites the combustible gases in the central space. The flame and heated gases diverge to the right and left through the flues, K, impinging on the outer surface of the tubes, and finally pass off by the flues, *f*, to the foot of the chimney, H. The currents of heated water and the steam, as generated in this arrangement of tubular boiler, flow in a nearly vertical direction through the inside of the tubes, *c*, and the water circulates down the back and front spaces, and thus a regular and uniform circulation is maintained throughout the boiler. Instead of forming the flue, *g*, as shown, the steam space, I, may extend to the outer shell of the boiler, and the products of combustion be carried through a series of tubes up to the chimney, the surfaces of these tubes serving to superheat the steam.

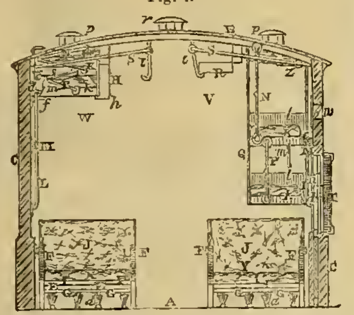
RAILWAY CARRIAGES.

J. H. JOHNSON, *London and Glasgow*, (EDWARD BURK & THOMAS A. ANDREWS, *both of Philadelphia, U.S.*)—*Patent dated Jan.* 30, 1861.

THIS invention relates to a peculiar arrangement and construction of the interior of railway carriages, whereby they are rendered specially applicable as sleeping cars for night journeys; also to a peculiar mode of arranging the seats, and adapting sleeping berths to the ordinary railway carriages at present in use, whereby each compartment is rendered capable of accommodating six passengers either in a sitting position or in a recumbent position.

Fig. 1 is a transverse vertical section of the body of the improved sleeping car, with its seats and couches, and other appliances; fig. 2 is a sectional plan of the same corresponding to fig. 1: fig. 3 is a detached view of one of the seats, showing the manner in which it is converted into a couch.

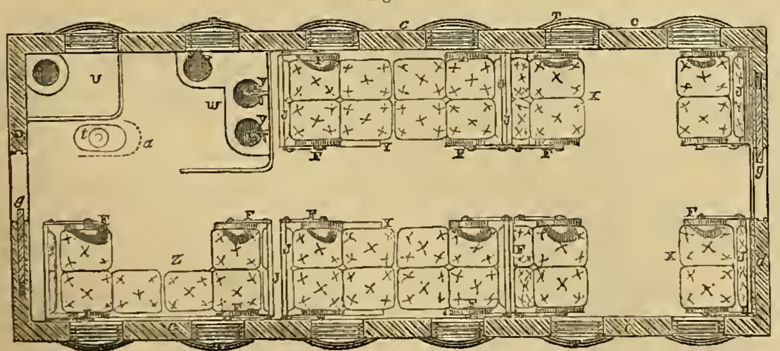
Fig. 1.



These figures relate to a car especially constructed for sleeping purposes, which comprehends the first part of this invention.

In fig. 1, A represents the floor line, B the roof, C and *c* the two opposite sides, and D and *d* the opposite ends of the car, the latter being furnished with sliding doors, *g*, in the centre or in a line with the passage from end to end of the carriage, which is made in one large compartment, with the seats and couches for the passengers ranged on each side of said passage—the seats being in a transverse and the couches in a longitudinal direction. As will be seen in the detached views, (figs. 3 and 4) each seat consists of a platform, E, secured to the two end frames, F, the position and arrangement of which within the car are shown in the sectional plan, fig. 2, the reversible back, J, of each seat being hinged by rods to the upper part of these frames, F.

Fig. 2.



Beneath the platform of each seat are two sliding boards, G, seen in figs. 1, 3, and 4, each board being furnished with, and supported by, two legs, *a*, and the boards being of such a length that when those of two adjacent seats are slid out, they meet or nearly meet each other, as shown in the central compartment of fig. 2.

To the front edge of the platform, E, of each seat are hinged two boards, I, of the same width as, and coinciding with, the sliding boards, G, and to the back edge of the platform, E, of each seat are hinged two boards, *i*, seen as half folded out in fig. 3. When the seats are arranged for day use, the boards, G, of each seat are slid inwards beneath the platform, B, and the boards, I, as well as the boards, *i*, are folded down on to the platform, so that the whole assumes the form represented at fig. 2, and in the detached view, fig. 4, which, when properly cushioned, affords a convenient and comfortable seat.

Fig. 3.

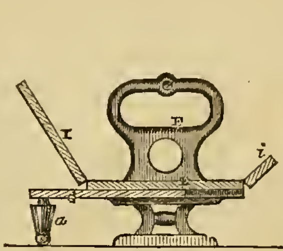
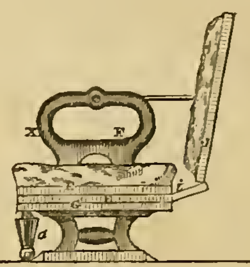


Fig. 4.



When the seats are to be converted into couches for night use, the boards, G, of two adjacent seats are slid out, so as to touch or nearly touch each other; the inclined backs, J, are raised to a vertical position, and the boards, I, as well as the boards, *i*, are then folded down so as to present a continuous level surface for the reception of suitable cushions or mattresses. In this condition the seats will assume the form represented at Y, in figs. 1 and 2, and afford a double berth sufficiently large for two reclining passengers.

It will be observed, as shown in the single compartment, marked Z, in fig. 2, that one of the boards, G, of one seat, and the opposite board, G, of the adjacent seat, may be slid out, and the boards, I, above the sliding boards folded down over the latter, as seen at Y, whilst the remaining boards, G and I, of the other two outer seats, retain their relative positions, shown at X; in this case the two adjacent seats will afford accommodation for one reclining passenger, and two who desire to retain a sitting position. This arrangement affords great conveniences for passengers travelling in company, some of whom may desire to assume a reclining and others a sitting position, and also affords accommodation for invalids without incommoding other passengers.

K and *k*, are two platforms, each consisting of a frame with sacking or other suitable material stretched across it for the reception of a mattress. The lower platform, *k*, has two staples, *d*, fig. 1, arranged to slide on the vertical guide rods, L, each rod being permanently secured at the lower end to the side of the car, and at the upper end to the roof of the same. The upper platform, K, has also two staples, *e*, arranged to slide on guide rods, M, secured to the car in the same manner as the guide rods, L. The opposite side of the upper platform, K, is connected at its extreme outer ends to the roof by the jointed rods, N, and the outer ends of the lower platform, *k*, are connected to the upper platform by the jointed rods, P, the rods in both instances being so situated as to support the front edges of the platforms when the latter are lowered for night use. The inner edge of the upper platform is supported by its staples, *e*, resting on the bent lower ends of the guide rods, M, and the inner edge of the lower platform is supported by its staples, *d*, resting on the bent lower ends of the guide rods, L. Straps, Q, are buttoned to the outer edges, or front of both platforms, and connected to the roof of the car so as to prevent the recumbent passengers from accidentally falling from the berths. When the platforms have to be elevated out of the way, they are simply pushed upwards from underneath, when the jointed rods, N and P, will be bent inwards towards the side of the car, and the staples, *d* and *e*, of the respective platforms slid upwards on their respective guide rods until the platform and jointed rods assume the position shown at W, fig. 1, where they are held on the inside by a turn buckle or other suitable device, *f*, and on the outside by a board, R, hinged to the roof of the car, and having a projection, *h*, which underlaps the front edge of the lower platform. When the platforms have to be lowered and arranged for night use, the board, R, is retained in the elevated position shown at V, fig. 1, by the hook, *i*, or other suitable appliance. Prior to raising the platform as above described, the head boards, *l*, fig. 1 (one of which is hinged to each platform, and the upper edges of which rest against the jointed rods), are folded down under the mattress, and the pillows of the four berths are strapped to the roof, so that when the platforms are elevated, the pillows are packed out of the way between the upper platform and the roof, as shown at *z*. The front edges of the platform are concealed by the hinged board, R, which may be suitably ornamented on the outside; nothing appears therefore to indicate the presence of the two platforms and their appurtenances, but a longitudinal box-formed projection at the corner of the roof. After simply moving the twin-buckle, *f*, and raising the hinged board, R, the platforms will at once fall and assume the proper position for night use. To each end of the upper platform, K, is hinged a hook, *m*, arranged to catch into a pin, one of which is secured to each end of the lower platform, *k*, thus maintaining the two platforms in close contact with each other, so that the upper platform only may be used as a sleeping couch, the lower platform being so far elevated as to afford head room for passengers occupying seats below. This arrangement affords ample convenience for a sleeping infant or reclining invalid, without disturbing the passengers below. A rod, S, placed near the roof of the car, passes above and all round the ends and front of the berths, and to this rod are hung curtains which may be made to inclose the whole of the berths. It will thus be evident that a space equal in length and breadth to that occupied by two car seats, and of the height of the car, is by the above-described contrivances rendered available for four convenient berths, each set of four berths being inclosed by separate curtains.

In the side of the car at a point midway or thereabouts between two seats are placed two ventilators, *n*, fig. 1, one just above the platform, K, and the other above the platform, *k*, these ventilators being of the ordinary valvular or any other construction whereby the admission of air into the interior of the car can be regulated at pleasure. It is also proposed to place in the roof of the car ventilators, *p*, of such a construction as to admit of the free egress of tainted air, and to prevent the ingress of rain, one of these ventilators being situate above each set of four berths. Independently of the last-named ventilators, there are placed midway between the opposite sides, and at suitable distances apart, larger ventilators, *r*. By this system of ventilation an efficient supply of pure air is allowed to enter the car, whilst the tainted air caused by the presence of a number of passengers crowded into a limited space has free egress.

In the summer months, when it becomes necessary to open the windows of the car, the recumbent passengers would be much annoyed by dust, sparks, &c., but for the presence of wire gauze arresters, T. These dust arresters are secured to the exterior of the car, one arrester in front of each window, and they are so constructed that they can be moved away from the windows when the latter are closed. Similar wire gauze arresters may be secured to the exterior of the car over each ventilator, *n*.

On reference to fig. 2, it will be seen that a corner of the car is partitioned off at U, so as to afford ample room for a water-closet, a necessary adjunct to a sleeping car, and near this closet is a stove guarded by a grated shield, *u*, so as to prevent the clothes of the passengers from being burnt. This stove is so attached to the floor of the car as to be readily removed when its use is not required during the summer months. Near the closet, U, another space, *w*, is partially enclosed by a partition as a lavatory, having a bench or table containing three or more wash basins, *x*, above which is a pipe, *y*, furnished with suitable cocks, the said pipe communicating with a reservoir overhead, which contains a supply of water.

The second part of this invention consists in the arranging the present body of first-class railway cars so that they will give sleeping accommodation to as many passengers as they are seated for. These cars having three compartments, each compartment having two transverse rows of seats, three seats in each row, and the whole being otherwise constructed in the same manner as the cars generally used on the English railways; the padded arms which are used as permanent divisions between the seats being so hinged to the partitions between the compartments that they can be moved back, and made to occupy a position beneath the padded back of the seat, so that the three seats are at once rendered available as a transverse reclining couch. Above each row of seats, thus converted into a couch, two platforms are suspended, constructed and arranged for adjustment in a manner similar to that described in reference to the platforms shown in figs. 1 and 2 of the first arrangement, and will therefore require no further description.

It will be seen that by this arrangement any of the ordinary railway cars can be readily converted into a convenient sleeping car without detracting from its utility as a day car, there being six berths or couches in each compartment, which in ordinary cars has seats for the accommodation of six passengers.

CARRIAGE SPRINGS.

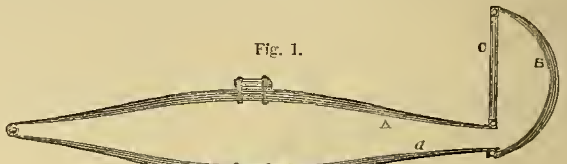
Arthur East Holms, *Derby.—Patent dated January* 22, 1861.

These improvements refer to elliptical springs, and this invention consists in connecting the plates forming the ellipsis at one or both ends through a bow or bows and loop or loops. The bow or bows may be formed of one or more plates of iron or steel, or other suitable metal or material, and the loop or loops may be made of leather, caoutchouc, webbing, or other like suitable material, strengthened or not with metal, as may be required.

Fig. 1 of the accompanying engravings is a side elevation of a carriage spring constructed according to this invention. A are the plates forming the spring, the lower set of plates, *a*, are connected at one end, as shown, to a metal bow, B. This bow is formed of steel plates, and rises perpendicularly or nearly so, and is connected at its up end to the upper set of spring plates, A, through the suspending loop, C.

In this spring the position of the bow, B, may be reversed, the top plates, A, being connected at one end to the bow, B, and the loop, C, connecting the other end of the bow and the lower plates, *a*.

Fig. 1.



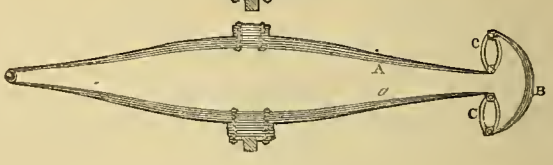


Fig. 2.

In another modification of this carriage, the upper plate spring, A, is connected to a bow B, made of a single bar of wrought metal; the lower end of this bow is connected to the lower plates, *a*, by a short loop, C, or by a link on each side of the spring, and in this case the bow, which is rigid, may be shorter than in the case of the spring, B, in the figure first described.

Fig. 2 is a view of a spring in which the bow, B, is composed of plates of steel, both ends of it being connected to the ends of the plates, A and *a*, forming the spring, by loops or links, C.

Fig. 3.

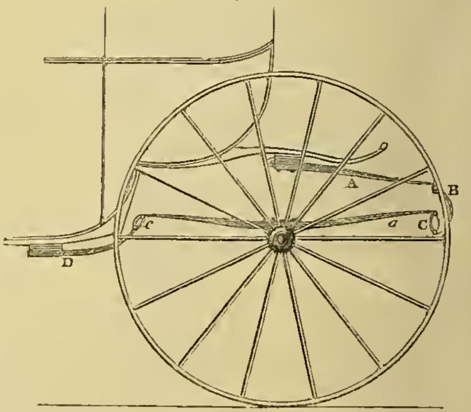


Fig. 3 shows the application of a modification of the springs just described to the back axle of a carriage. The upper elliptical plates, A, being only a half spring attached above the axle to the extended frame of the carriage, and its outer free end to the same end of the lower spring, *a*, by the rigid bow, B, and loop, C, while the inner end of the lower spring, *a*, which is fixed to the axle, is linked also by a loop, *c*, to a half spring, D, made fast to the frame under the carriage.

Fig 4

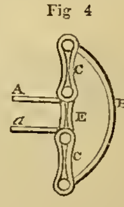


Fig. 5.

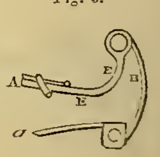


Fig. 4 shows the ends of a spring with a brace, E, from top to bottom of the bow, B. The brace has two ferrules secured in it to receive the ends of the elliptical plates, A.

Fig. 5 is a similar view of a spring fitted with a brace, E, extending about half along the under side of the elliptical plates, A, and turned up to take the top of the bow, B, which is secured to the plates, A, as shown.

This last modification, like fig. 1, is also capable of being reversed upside down, that is, having a brace, E, fitted to the lower plates, *a*, instead of to the upper plates, A.

In all the modifications of this carriage spring, consisting of a series of flat elliptical plates, sufficient distance being left between the two springs, A and *a*, to allow of their free working with the weight of the carriage. These springs are smoother in their action, and produce much less vibration and noise than other arrangement of springs which have heretofore been in use.

MOULDING AND SHAPING METALS.

James Hunter, *Coltness Iron Works, Lanarkshire.—Patent dated March* 14, 1861.

This invention relates to an improved mode of casting wheels, rails, pillow blocks, and other generally similar details, so as to obtain hard and durable surfaces thereto, as well as economy of time and expense in moulding. Under one modification, the mould in which the wheel or other article to be cast is formed, is made entirely of iron. The mould is formed in two parts, in manner similar to the ordinary sand moulds. These parts are placed one upon the other, and, when so arranged, a cavity is left between the parts corresponding to the form of the wheel to be cast. A metal core is arranged in the centre of the mould, which passes through the two parts, and thus forms the aperture in the centre of the wheel to receive the axle or spindle, which may be either fast or loose. A vertical tubular aperture or "gate" is formed in the upper half of the mould which conveys the molten metal down into the cavity formed in the body of the mould; the mouth of the "gate" is surrounded by a ridge which slopes down to the aperture, and serves to prevent the overflow of the metal. In casting angle iron rails, pillow blocks, or the footstep bearings of shafts, and other similar details, the moulds are formed of cast or malleable iron, the minor details of which are arranged to suit the article to be produced.

Fig. 1 is an elevation partially in section of these improvements, as applied to the casting of the wheels used for the hams or small carriages used in coal-mining. Fig. 2 is a transverse sectional elevation of the arrangement corresponding to fig. 1, and figs. 3 and 4 are elevation and plan views of the wheel castings produced by the apparatus. The apparatus, delineated in figs. 1 and 2, consists of a rectangular framing, A, formed by preference of cast-iron. This framing has formed in the upper part a series of transverse recesses, in which the mould boxes, B, are placed, and fastened therein by means of wedges driven in between the faces of the recess and the mould-box. The mould is formed of cast or wrought iron; the lower part, B, has in it a central aperture through which the moveable spindle or core, C, passes. This core piece is either of a circular or square figure in its transverse section, and it forms the central opening in the cast wheel. If the wheel is intended to rotate on the axle of the carriage, the central aperture is made circular, but if the axle is to rotate, then the aperture in the wheel is made square so that it may be easily keyed thereto. The lower end of the core, C, rests upon the inner portion of the hand lever, D, which is weighted at the inner part, so that it remains in a horizontal position when not otherwise acted upon. The lower part of the mould has also four tubular openings in it, in which are fitted the prints, E. These are either of a triangular, circular, or other figure, in their transverse section, and they form the openings shown in the wheels, F, fig. 3. The upper part, G, of the mould is formed of cast-iron, with a central opening for the upper end of the core, C, to pass through. In this part of the mould, two "gates" or funnel shaped openings, H, are formed, these openings taper downwards and enter the internal cavity of the mould. The upper part, G, of the mould has formed on it four laterally extending handles, I, by means of which the upper part is lifted off, or turned round as required. The parts of the mould being arranged as shown in figs 1 and 2, the molten metal is poured into the mould by means of a double lipped ladle, so that two streams of metal run simultaneously in by the funnels, H. The moment the mould is filled with the molten metal, the workman turns round the upper part of the mould, G, which has the effect of severing the metal at the small ends of the funnels, H, and so leaves the surface of the wheel complete. The top of the mould is now lifted off, and may be reversed to get out the moulded pieces in the funnels, H, the hand lever, D, is depressed, which raises the core, C, and with it the moulded wheel which is now complete, and corresponds in figure under one form to that delineated in figures 3 and 4. The surfaces of the metal being instantly chilled by its contact with the metal mould, it is rendered very hard, and these wheels made in this way are consequently far more durable than those of the ordinary kind. Another arrangement of moulds for casting the angle rails for forming tram-ways is described in this specification. In this modification the lower box is formed of cast or malleable iron, and is made of a length corresponding to the length of the intended rail. The inner part of the box forms a comparatively deep channel along the centre, and a portion of smaller depth extending laterally on each side, forming a T shaped figure in the transverse vertical section. Two loose bars are placed longitudinally in the bottom of the box, these bars are tapered slightly towards the upper parts, and between them is placed a third bar. The top part of the box is then placed on, which serves to keep the bars in position during the casting. If the rails are cast on the level the metal may be poured in at the top. The molten metal flows along the L shaped space, between the bars and the inner faces of the box, and thus forms a pair of rails at each casting. If preferred the box may be supported on a laterally projecting stud, and the rails cast on end. In this case, the middle bar may form a part of the upper portion of the box, or it may be temporarily secured to the bottom part of the box by means of a clamp driven on with a hammer, and taken off in the same manner when the casting is completed. Under another modification the loose bars are dispensed with. The lower part of the box is similar to the former arrangement, the sides of the box are formed with snugs projecting upwards in an angular direction, and the top of the box is formed in two parts, each having outwardly projecting snugs to admit of their being hinged to the lower part. These top parts are so formed as to leave a space between their inner faces and that of the lower part of the box, corresponding to the thickness of the intended rail. One end of the box is extended to a semicircular figure, and in this part is formed the apertures for pouring in the molten metal, which is done by means of a double-lipped ladle. As soon as the metal has set, the top parts are thrown back on their hinges by means of handles, and the two rail castings are taken out.

Fig. 1.

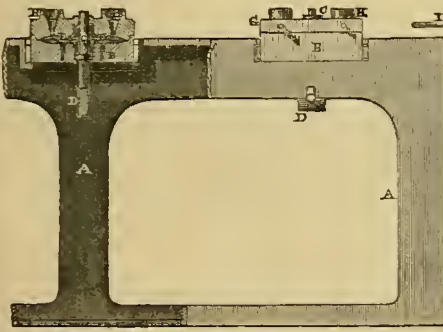


Fig. 2.

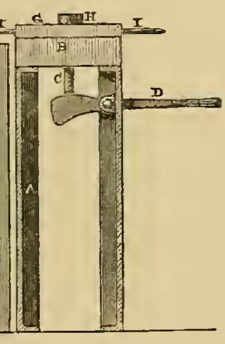
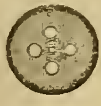


Fig 3.



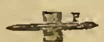


Fig. 4.

In another arrangement of this invention for casting pillow-blocks, the lower part of the box is made of malleable or cast iron, and forms a series of cells shaped to the figure of the pillow-blocks to be cast. In the central recess of each mould is fitted a core piece, and the bolt holes of the pillow-block are formed by points or vertical pins, which may either be cast or formed in one with the lower part of the box, or they may be moveable, and be fitted into tubular openings. The top part of the box is also formed of malleable or cast iron, and has in it the funnel shaped openings to admit of the molten metal reaching the interior of the mould. The metal is poured in at the openings or funnels, and, when set, the top of the mould is removed, and the castings are lifted out by raising the core pieces, which are either actuated by hand-levers, as shown in figs. 1 and 2, or by other equivalent means. With moulds formed in this manner, the casting of pillow-blocks, footstep bearings, and other generally similar, details may be carried on with great rapidity and economy, at the same time producing chilled castings of superior quality and durability.

CAST-STEEL RAILWAY WHEEL TYRES.

J. & M. Spencer, *Newcastle —Patent dated March* 25, 1861.

Messrs Spencer's invention relates to the manufacture of cast-steel railway and other wheel tyres or hoops in a solid ring in a suitable mould or matrix, such ring being afterwards hammered, and, when necessary, finished by rolling in the usual way.

LUBRICATING COMPOUND

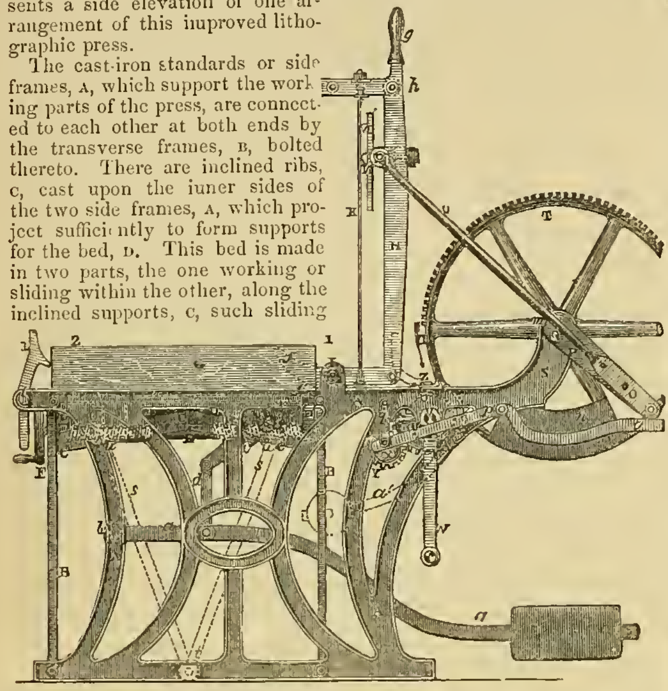
J. Oswald Earle, *Liverpool.—Patent dated March* 30, 1861.

The lubricating compound produced under this patented process consists in the admixture of lime water with oils, whereby an economical and efficient lubricant is obtained. In carrying out this invention in practice, a solution of lime is made either by a direct solution of caustic lime in water until a thoroughly saturated solution is obtained, or the lime water is produced by the chemical decomposition of a solution of salt of lime. This solution of lime, or lime water, is then mixed in about equal proportions with either sperm, olive, rape, lard, fish, or animal oils, and well agitated.

LITHOGRAPHIC PRESS.

J. R. Joy, *Bristol.—Patent dated January* 17, 1861.

This invention relates to a peculiar construction and arrangement of lithographic printing presses, whereby they are rendered, to a certain extent, self acting, and are enabled to turn out a much greater amount of work in a given time than the ordinary presses hitherto employed for the purpose of lithographic printing. The subjoined engraving represents a side elevation of one arrangement of this improved lithographic press.



The cast-iron standards or side frames, A, which support the working parts of the press, are connected to each other at both ends by the transverse frames, B, bolted thereto. There are inclined ribs, C, cast upon the inner sides of the two side frames, A, which project sufficiently to form supports for the bed, D. This bed is made in two parts, the one working or sliding within the other, along the inclined supports, C, such sliding movement being obtained from the right and left hand screw spindle, E, which works in nuts on the underside of the two halves of the bed, and is actuated by the hand wheel, F, fast on the front end of the spindle. The bed, D, supports the stone G, and when its two halves are caused to approach towards or recede from each other, by suitably turning the hand wheel, F, they ascend or descend along the inclined supporting rails, C, and consequently raise or lower the stone according to the degree of pressure required, such vertical adjustment of the stone being effected at the commencement of each job, after which the pressure of the scraper thereon will be the same at each pull without any further alteration or adjustment. In this press the bed, D, and stone, G, do not move to and fro under the scraper, as in the ordinary machines of this kind, but has a tympan and pressure frame, H, made of wrought iron, working on a centre at I, which carries the leather or metallic tympan, K, and is provided at its front or free end with two small rollers at *h*, which pass underneath the respective catches, L, when the frame is brought down on to the stone. These catches serve to hold the frame, H, down during the passage of the scraper over the tympan, they are hinged at *l*, to the main framing, and are pushed back so as to release the frame H, by the projecting rods, M, attached to the scraper, N, carried by it, such release taking place only when the scraper travelling in the frame, H, has passed over the stone, when the forward ends of the rods, M, come in contact with the upper ends of the hinged catches, L, and throw them off the rollers, *h*. The scraper which is carried and slides between the sides of the pressure frame, H, is connected at each extremity outside the said frame to the two connecting rods, O, actuated by the cranks, P, fast on the shaft, Q. This shaft revolves in bearings in the brackets, S, and carries a toothed segmental wheel, T, one half of the circumference only being provided with teeth as shown. These teeth gear into the teeth of the spur pinion, U, fast on the driving or first motion shaft, V, which shaft may either be rotated by means of the winch handle, W, or by steam or other power through the shaft X, which is provided with a spur pinion, Y, gearing into a spur wheel, Z, on the shaft, V. In another modified arrangement of driving gear, there are three segmental wheels, T, one keyed upon the shaft, Q, each wheel being of a different diameter to gear into a corresponding pinion of its own, fast upon a collar or tube, sliding on a feather on the shaft, V, so that any one of the pinions, U, may be brought into gear with its respective segment wheel, thus enabling the press to be worked at three speeds. There are also three holes in the cranks, P, which correspond with similar holes in the lower ends of the connecting rods, O, so that by shifting the crank pins from one hole to another the travel of the scraper may be varied according to the size of the stone. *a* is a weighted lever for lifting the pressure frame, it works on a centre at *b*, and is connected to one end of the lever, *c*, by the link, *d*, the opposite end of the lever, *c*, being provided with an antifriction roller, *e*, which bears against the underside of the curved arm, *f*, attached to the pressure frame, H. The weight on the lever, *a*, tends to elevate the roller, *e*, and force it constantly against the arm, *f*, so that immediately the pressure frame is released from the retaining catches, L, it turns up on its centre, I, and assumes the vertical position indicated in the engraving, to admit of the removal of the sheet, and of the inking of the stone for the next impression. The act of bringing down the pressure frame, H, by means of the handle, *g*, causes the scraper to traverse to the back end of the frame, so as to be in readiness to pass along the stone, in the direction from 1 to 2, and at the same time turns the segment wheel slightly round in the direction of the arrow, and brings the first of its teeth into gear with those of the spur pinion, U. This partial turning of the segment wheel is effected through the lever action, for the time being, of the connecting rods, which rest near their longitudinal centres upon the stops, *m*, fixed to the bosses of the cranks, P, and forming fulcra for the rods to act upon, consequently the cranks are forced upwards as the opposite ends of the rods, with the scraper, are forced downwards by the descent of the pressure frame, thereby giving the required partial rotation to the segment wheel. The pressure frame having been locked by the catches above referred to, and the teeth of the segment wheel brought into gear with the spur pinion, U, the motion of the segment is continued by turning the winch handle, and the scraper is pushed forward from 1 to 2, over the tympan, which now rests upon the surface of the stone, by the rotation of the cranks, P. *n* is a counterweight fixed in the plain portion of the periphery of the segmental wheel, T, and by the time the scraper has traversed the stone, this weight will have passed the dead centre, and on the release of the pressure frame, will, by its descent to the position shown, complete the revolution of the cranks, and allow of the return of the scraper, such operation being effected simultaneously with the rising of the pressure frame. The stops, *m*, are hinged so as to allow the connecting rods to pass them in one direction. The scraper box, N, is provided with antifriction rollers on its underside, and at the top with a spring to bear up the weight of the box, the whole passing freely along the frame, H, which is made strong enough to sustain the pressure. A bent lever, *o*, works upon a centre at *p*, in a plane, with a pin projecting from the inside of one of the cranks, P. This pin acts upon the edge of the lever, and checks the momentum of the segment wheel, and retains the cranks in their normal position, as shown in the drawings. The elastic spring, *q*, attached to the other end of the lever, to a stud on the side of the frame, A, gives the necessary pressure or buffing action to the end of the lever against the stop pin at *r*. In another arrangement, which the patentee has described in his specification of this press, the scraper box, N, is actuated by cranks, P, as in the first arrangement, but the shaft, Q, in place of carrying a segment wheel is provided with a full spur wheel, T, which is caused to rotate by the spur wheel, U, such wheel effecting the complete rotation of the wheel, T, and having no counterweight. The weighted lever, *a*, link, *d*, lever, *c*, and curved arm, *f*, in connection with the pressure frame, are also dispensed with, and replaced by a weighted curved arm attached direct to the back end of the pressure frame itself, the arc of the curve being drawn from the centre, I, so as to clear the shaft, V, as dotted in at a^1. The stone, G, in place of being elevated by an incline action, is raised or lowered as required, by the aid of the two radial rods or levers as dotted in at *s*, jointed at their lower ends, *t*, to a cross-bar in the main framing, and severally jointed at their upper ends, *u*, to nuts sliding in the underside of the bed or table, D, which supports the stone. These nuts are actuated by means of the right and left hand screw spindle, E, and hand wheel, F, as before described in the first arrangement, so as to cause them to approach towards each other, and thereby effect, through the action of the rods or levers, *s*, the elevation of the stone, or to recede from each other and produce the reverse effect. In both presses the screw spindle, E, must be free to rise and fall with the bed or table, D.

PURIFYING WATER.

John Cameron, *Hindpool, Lancashire.—Patent dated Feb.* 2, 1861.

The patentee's improvements consist in mixing with the water before it is put into the boiler a certain quantity of partially decayed vegetable matter such as peat, black vegetable mould, leaves, twigs, and roots of trees, or vegetable matter charred by acid in order to obtain humic and ulmic compounds, or old wood in a partially decayed state, or grasses or vegetable mould of any description answering the purpose. He employs these substances for the organic compounds which they contain, such as humin, ulmin, humic acid, ulmic acid, crenic acid, and apocrenic acid, with others of a similar character which exist in partially decayed vegetable matter.

These compounds have a powerful affinity for lime, magnesia, oxide of iron, and alumina, and form with them insoluble compounds which precipitate and leave the water so treated pure, soft, and well adapted for the supply of steam boilers, and for other purposes.

In the first place the patentee forms a tank or reservoir in two divisions which may hold from 50,000 to 60,000 gallons of water, each division of the tank to hold, say 25,000 gallons; one division of this double tank is at lower level than the other, so that the higher half of the tank may have sufficient fall to empty itself into the lower division. The upper half of the tank is filled with the water to be operated upon according to the process. Into 25,000 gallons of water 30 tons of peat are placed, which substance is preferred in preference to other vegetable substances, although the patentee does not confine himself thereto. The peat in part is dry when put into the water, so that it may float on the surface, and part is put into the water in a wet state so that it may sink through the water to the bottom of the tank. The water then left at rest for a certain time, and occasionally tested till it is found to be freed from the earthy substances, namely, lime, magnesia, oxide of iron, and alumina, which are the ordinary deteriorating matters contained in hard water. After these earthy materials of the water have been precipitated by the organic compounds, humin, ulmin, humic acid, ulmic acid, crenic acid, and apocrenic acid, existing in the peat, the water is run into the lower division of the tank when it is ready for use. The filling of the upper division of the tank is repeated and proceeded with in the same way, occasionally stirring up the peat from the bottom of the tank so as it may act on the whole body of the water. The patentee does not confine himself to any form of tank or reservoir, as he finds that he can treat fountains or ponds in a similar way. Nor does he confine the carrying out of the invention to any given quantity of partially decayed vegetable matter, as some waters will not require so much as others, this depending upon the amount of earthy matters contained in the water so treated. For domestic purposes three pounds of peat will soften the water, if hard, four weeks without being renewed if left for twenty-four hours in contact with it, and agitated occasionally so as to bring the organic compounds above mentioned to act upon the whole of the water. If he prepares these organic compounds by means of acids, he prefers to use the sulphuric acid, as it acts upon all kinds of vegetable matter very rapidly; about two pounds of acid to the one hundred pounds of vegetable matter will produce the required effect.

SKATING CHAIR.

J. H. Johnson, (*A Communication from* Frederic Ashley, *New York*) —*Patent dated March* 23, 1861.

Mr Ashley's invention relates to an arrangement of chair to be pushed along the ice after the manner of a sledge, and consists in constructing a chair with a folding frame and flexible back and seat, so that the whole may be closed up and made easily portable for being carried, and may be opened out when required for use. At the bottom of each leg support is fitted, in any convenient manner, a runner or skate iron, which may be made to turn up parallel to the legs of the chair when packed for transport.

Fig 1.

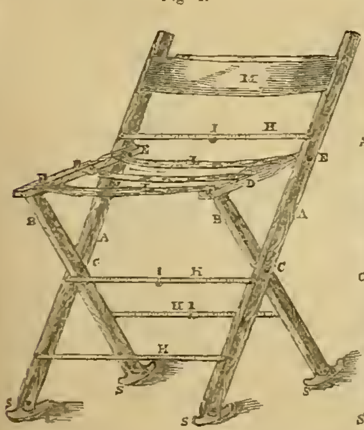


Fig 2.

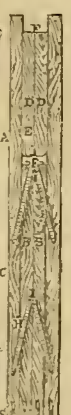


Fig. 1 of the engravings represents a perspective view of one form of skating chair constructed according to this invention, and expanded in its proper standing position ready for use, and fig. 2 represents the same closed in its portable form. At A are the main side pieces which form the front legs and the supports for the back. B are the other side pieces, which, by being attached to the pieces, A, by bolts, C, can be turned out to such an angle as to form the back legs, and also to give a bearing to the arms, D, which arms by being properly hinged, or secured by bolts, E, can be brought to fit upon the tenons, F, on the ends of the pieces, B. H are cross braces for connecting the sides, A and B. They are made with hinged joints at I, so as to admit of the frame being closed laterally as shown in fig. 2. L is the seat, made of webbing or other suitable material, attached to the arms, D. M is the back, composed of similar material, and attached to the sides, A. S are the runners or skates made to move loosely on the pins which hold them in their places on the lower extremities of the legs, A and B, so as to allow of their being turned longitudinally with the legs when packed up, as shown in fig. 2, and of having a sufficient freedom or play when sliding over uneven surfaces on the ice, for which latter purpose also they are curved or turned up slightly at each end. In closing the chair when required to be carried any distance, the side pieces, B, and the arms, D, are so turned on their centres or bolts as to bring them parallel to the sides, A, which are then closed laterally by folding up the hinged cross braces, H, at the points, I, until all the parts are brought together, and so reduced to a convenient and portable size. When required for use upon the ice, the chair is opened or expanded out, whereupon the flexible seat and back will become properly adjusted. Under another modification, the skating chair folds up, but the upper parts are hinged, and are retained in an easy inclined position suitable for the body by leather or other straps, which are capable of being lengthened or shortened so as to alter the position of the back by means of metal loops or buckles. The back, in lieu of being made of flexible material, as in the first described chair, may be made moveable and connected to the back and supports, by means of a stud and slot attachment. In some cases short runners or skate irons may be fitted to the bottom of the legs or supports of chairs of the ordinary construction, but the folding chairs will be found most convenient.

SPADES AND SHOVELS.

Samuel Jackson, *Sheffield*—*Patent dated March* 22, 1861.

This invention relates to a mode of manufacturing spades, shovels, and other articles of a similar nature, whereby they are rendered much more durable and perfect in their manufacture than those constructed by the ordinary welding process. The patentee proposes to construct the blades of articles of the above description out of one solid piece of cast-steel, which, after having a hole punched therein for the reception of the handle, is forged and rolled down to the desired shape and thickness, thus forming the blade of one piece of cast-steel throughout without the necessity for welding, or for the use of rivets.

Fig. 1.

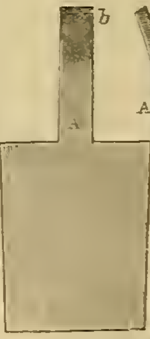


Fig 2.

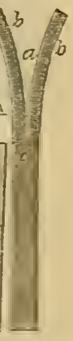


Fig. 1 represents a face view of a slab or solid piece of cast steel, having a tail piece, A, formed thereon under a powerful press, by the aid of suitable dies. The tail part or shank of this slab is then slit open, as shown at *a*, in fig. 2, which is a side elevation of the slab, such slitting being effected by means of a suitable slitting tool placed in the same press. The straps, *b*, are thus formed, from which the socket for the handle is subsequently made. A hole is then punched into the solid part of the slab for the reception of the end of the handle, as shown in dotted lines at *c* in fig. 2, when the entire slab is ready to be rolled and finished into a spade or shovel in the usual manner.

STEAM ENGINES AND BOILERS.

William Weallens, *Newcastle-upon-Tyne*.—*Patent dated Feb.* 27, 1861.

This invention relates, in the first place, to high and low pressure engines for marine and other purposes, provided with two cylinders only, and with a simple and effective arrangement for starting and reversing the engines. This is effected by working the slide of the low pressure cylinder by means of a link motion, or by the wedge motion, this motion being entirely independent of the valve motion for the high pressure cylinder.

For the convenience of starting the engine, a cock or valve is used to charge the low pressure slide chest with high pressure steam, this steam being admitted to the desired side of the piston by the above-mentioned valve motion. After the engine is started, the cock or valve is closed, and the low pressure cylinder takes steam from the high pressure exhaust in the usual way of compound engines. In order to prevent any excess of steam pressure when starting the engine by admitting high pressure steam into the low pressure valve chest, a safety valve is placed on, or in connection with the low pressure slide valve chest, this safety valve being arranged so as to blow off at any desired pressure, thus preventing any chance of injury to the low pressure machinery. The second part of this invention relates to a peculiar construction and arrangement of a high pressure boiler, so as to enable it to be easily cleaned and repaired in all parts, whilst it possesses great strength, and forms, in all respects, a most efficient steam generator. The main portion of this boiler is somewhat similar to a locomotive boiler, on the top of which a second cylindrical barrel is placed; this upper barrel contains either one or two distinct sets of tubes, the one set of tubes, where two sets are used, serving to heat the feed-water, and the other set for superheating the steam; these two sets of tubes are placed exactly opposite each other, so that they may both be cleaned from the smoke box end, whilst the whole of the tube plates, both in the upper and lower barrel, are easy of access. The flames, after passing through the tubes in the lower barrel, enter into a combustion chamber which is provided with water or steam spaces all round, these water or steam spaces forming a passage for steam or water from the lower barrel to the superheater. The combustion chamber is constructed and stayed similarly to the sides, front, and back of a locomotive fire box. The third part of this invention relates to the propelling and steering of vessels by the aid of screw propellers, so arranged as to be capable of steering a vessel as well as propelling it, in connection with an apparatus for regulating the speed of such propellers. This arrangement consists of two screw propellers, placed one at each side of the ship's stern, and worked entirely independently of each other. When the ship is to be steered by the engines only, or when the engines are to assist the rudder in doing so, the two engines, each working one propeller, can be connected with a combination of wheel-work, by means of which the throttle valves are so regulated that both engines will work at the same speed when the ship is going straight on its course. This apparatus is easily connected or disconnected, and is also applicable to paddle-wheel engines or land engines.

Fig. 1.

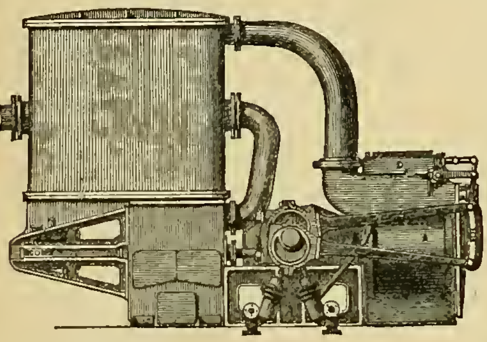


Fig. 1 of the subjoined engravings represents a side elevation of an improved combined high and low pressure engine, arranged according to the first part of this invention; and fig. 2 is a transverse vertical section of the same, taken through the cylinders. A, is the low pressure cylinder, and B, the high pressure cylinder in communication therewith. C and D, are the respective slide valves of the high and low pressure cylinders, and E, is a cock for the purpose of charging the low pressure slide chest, with high pressure steam in order to start the engine. A safety valve, F, is also fitted on to the same low pressure valve chest, to prevent any undue pressure therein. The slide valves, C and D, are worked by the wedge or link motion, as shown in fig. 1, but it is important that both slide valves should work independently of each other. Fig. 3 is a longitudinal vertical section, and fig. 4 is a half transverse vertical section of the improved boiler, taken through the combustion chamber corresponding to fig. 3, and showing the feed water heater, arranged according to one modification of this high pressure steam boiler, which forms the second part of this invention. The main barrel, A, of the boiler, which is provided with tubes, B, running between the fire box, C, and the combustion chamber, D, and is otherwise constructed in a similar manner to an ordinary locomotive boiler. The combustion chamber, D, which is in communication with the fire box, C, through the boiler tubes, B, is extended upwards in front of a second barrel, E, which is fitted on the top of the main barrel, A, and a second set of tubes, F, are fitted inside this barrel, opening at one end into the upper portion of the combustion chamber, D, and at the other end into a small chamber, *d*. A third set of tubes, O, connect this small chamber, *d*, with the smoke box, H, and a tube division plate or partition at *a*, separates this portion of the barrel, E, from the other portion containing the tubes, F, this separated portion forming in conjunction with the tubes, O, constitutes an efficient feed-water heater, in which the water circulates round the heating tubes, G. The combustion chamber, D, is surrounded by a steam and water space, *b*, which allows the steam generated in the lower or main barrel, A, to circulate freely round the series of tubes, F, in the upper barrel, such tubes acting as superheaters. The arrows in fig. 3 indicate clearly the course of the draught. Fig. 5 is a longitudinal vertical section of the upper portion of another modification of this improved high pressure boiler, which is constructed without the feed-water heater. Fig. 6 represents an end elevation of the smoke box, and partially transverse vertical section of the upper barrel, E, of the boiler, showing a section of the steam-heating tube, F, and one of the division plates, O, of the same modification, and corresponding to fig. 5. This boiler is somewhat similar to the one just described in reference to figs. 3 and 4, but is constructed without the feed-water heater; O, is a series of baffle plates fitted inside the upper barrel or superheating portion, E, of the boiler, steam passages, *g*, being left at the top and bottom, alternately, of each plate, so that the steam generated in the lower or main barrel, A, has to traverse, in the direction of the arrows, up and down across the series of superheating tubes; the remaining parts of the boiler are similar to those illustrated in figs 3 and 4, and are indicated by similar letters of reference. Fig. 7 represents a vertical end elevation of a pair of marine engines and regulating apparatus for driving the screw propellers constituting the third part of this invention; and figs. 8 and 9 are enlarged details of the regulating apparatus which are hereinafter described. A and B, are the two shafts of ordinary screw propellers, placed one on each side of the stern post of a vessel, and each capable of being driven independently of the other, when required for the purpose of steering, or of assisting in steering, the vessel, by its own separate engine. These engines are also capable of being worked in concert, or at the same speed, when the propellers are required simply for the purpose of propelling the vessel, without influencing the steerage of the same. For this purpose a peculiar self-acting regulating apparatus is employed for controlling the respective throttle

Fig. 2.

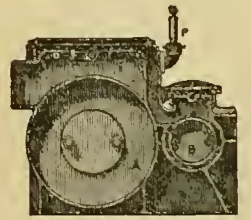


Fig. 3.

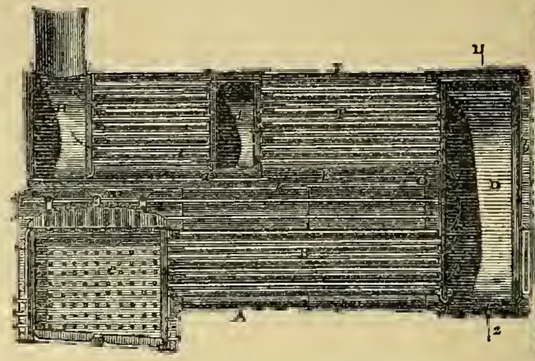


Fig. 4.

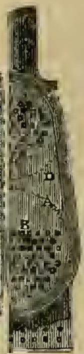


Fig. 5.

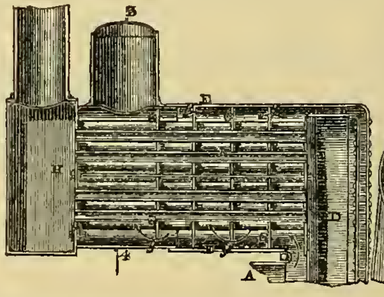


Fig. 6.

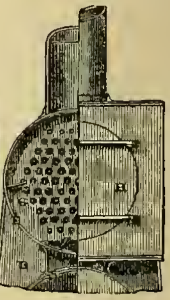
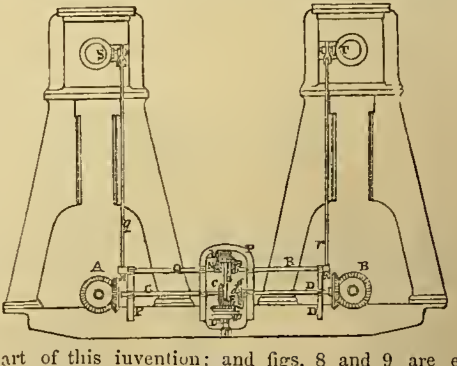
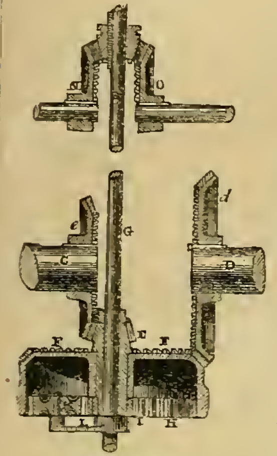


Fig. 7.



valves of the two engines, so that each engine will perform the same number of revolutions. This regulating apparatus is shown in detailed vertical section and plan at figs. 8 and 9 respectively, and consists of two bevel wheels, *e* and *d*, fast on the shafts, C D, driven by the engines separately, these wheels, *e* and *d*, gearing respectively into the wheels, E and F; the bevel wheel, E, revolves freely within the boss of the wheel, F. The bevel wheel, F, is cast in one piece with an internal spur wheel, H, and a spur pinion, I, is fast on the lower end of the boss of the bevel pinion or wheel, E; a spur pinion, K, gearing simultaneously into the internal wheel, H, and spur pinion, I, and revolving freely on a stud in the end of the crank or arm, L, keyed on to the lower end of the vertical shaft, G. On the upper end of this shaft is fitted to slide along a feather, a bevel pinion, M, fig. 7, gearing into the two segmental tooth wheels or racks, N and O, fast on the two shafts, Q and R, respectively, and connected at their other end by a lever to vertical rods, *q* and *r*, of the throttle valve spindles of the two engines. The diameters of the several wheels and pinions, *e*, *d*, E, H, I and K, are so calculated that when *e* and *d* (or the two engines) make the same number of revolutions, the speed of the pitch lines of the wheel, H, and pinion, I, is the same, and their rotation, however, being in opposite directions, the wheel, K, will therefore revolve upon its stud-pin without producing any motion in the lever arm, L. But so soon as any difference occurs in the speeds of the two wheels, *e* and *d*, or the two engines, (these wheels being driven direct from each engine separately, as shown in the front view, fig. 7) the same difference of speed will take place on the pitch lines of H and I, and the lever, L, will revolve in the same direction as the wheel (either H or L) which has the greatest speed on the pitch line, and will consequently turn the shaft or spindle, G, together with the bevel pinion, M, and sections or segments, N and O, in connection with the two throttle valves, S and T, of the two engines, so as to open the valve, S, or close the valve, T, or *vice versa*, as required. By throwing the bevel pinion, M, out of gear, the regulating apparatus will cease to act, when each engine may be worked at a different speed, so as to produce the steering effect required.

Fig. 8.



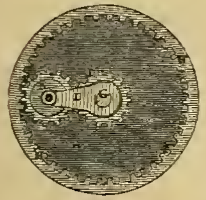


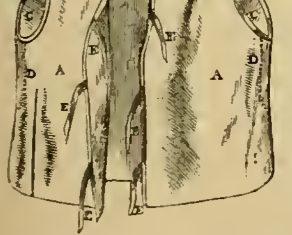
Fig 9.

REGISTERED DESIGNS.

LIFE PRESERVING VEST.

Provisionally Registered for Mr William Gall, *of South Constitution Street, Aberdeen.*

The purpose of utility to which the configuration of this design has reference is the obtainment of a simple and effective life preserving garment, which may be worn uninflated as an article of dress in cold weather, and may be readily inflated whilst on the body when danger from drowning occurs. The subjoined engraving represents the "life preserving vest;" it consists of a double thickness of waterproof material, A, so cut or shaped as to fit round the back and over the chest of the wearer, and for that purpose it is shaped to fit the neck at B, and is provided with arm holes at C. Beneath those arm holes the two thicknesses of the material are united for a short distance down, as shown by the dotted lines at D, the object of this being to prevent inflation at that part, and thereby afford greater freedom to the arms of the wearer. The rest of the garment forms an air-tight bag, which is inflated by blowing air into it through the mouth-piece, *a*, provided with a stop valve, which is closed by turning the milled-headed thumb screw, *b*. Tapes or strings, E, are provided for tying the garment in front of the wearer.

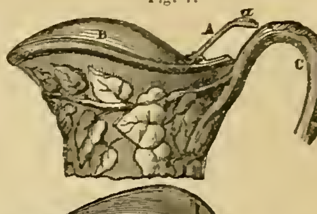


LIFT OR OPENER FOR THE COVERS OF JUGS.

Provisionally Registered for Mr W. H Ridgway, *of Northwood, Hanley, Staffordshire.*

The object of this improvement is to provide simple and easy means of opening the hinged covers of jugs or other vessels so fitted. Figs. 1 and 2 of the accompanying engravings represent respectively a side elevation and plan of the "lift" or "opener" applied to the cover of a hot water jug. A is the "lift," which consists of a piece of metal soldered to the cover, B, and so bent or deflected laterally as to allow of its passing down one side of the handle, C, of the vessel when depressed for the purpose of opening the cover. *a* is a button of slowly conducting material fixed to the end of the "lift," and upon which the thumb is pressed when the cover is to be opened.

Fig. 1.



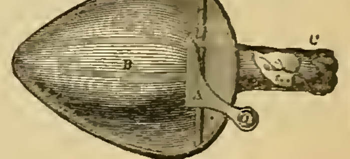


Fig. 2

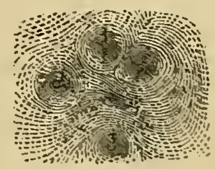
CORRESPONDENCE.

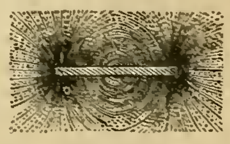
THE MAGNETICAL DEVIATIONS OF THE COMPASS.

V.

In the former paper, I have stated that the strength of the magnetic condition depends much on the direction in which the iron has been rolled; and I am far from thinking that iron which readily indicates the flow of magnetism is of an inferior quality. This conclusion I have come to from extensive observation and practical experiments; keeping first principles in view, it seems to be clearly indicated that the strength or flow of the magnetic current depends on a certain arrangement of the atomic mass composing the bar or plates; and this arrangement of the mass is induced by the bars or plates being rolled in a polar direction, which will at all times induce a free current of magnetism; and I believe that this atomic arrangement of the mass is calculated to improve the quality of the iron. It has been proposed to determine the quality of iron by its magnetic condition, that is, iron which indicates a free flow of magnetism is inferior; the sooner that this idea is corrected the better, as it will not stand the test of observation and experiment, for we know, from the latter, that bars of steel which may be hardened near to the magnetic meridian will immediately indicate distinct polarity, and the bar which may be hardened east and west will be indifferent to polarity, and will never indicate a strength of magnetism equal to the former, when both are magnetised by the galvanic battery.

Let us now examine indications that we may have a clear perception of the magnetic influence from a steel bar which has been magnetised. Suppose it to be placed under a sheet of paper and iron filings strewed over it, when the paper is gently tapped these particles form themselves into curves, taking a distinctive eliptical form, as shewn in the annexed engraving; but if the magnet be held above the paper the effect is just the reverse. A bar or needle will at all times produce similar effects to the above; the first of those apparent properties are attraction and repulsion. In a former paper, I have referred to these properties, and endeavoured to show that those apparent effects are the result of one great, simple, primary cause—the flow of energy; and it is only by a certain arrangement of the atomic mass that this energy is made apparent. Then it seems clear that this energy, in its indications,





flows as a current. The question now is, what are the indications when a current flows? First, it sets in a particular direction, as north and south; then it must be evident that, if a current were setting from south to north, that the two currents must repel each other; if they be equal, an equilibrium is the result, and the energy for the time appears suspended. This, so far, gives us an idea of the principles of repulsion and energy.

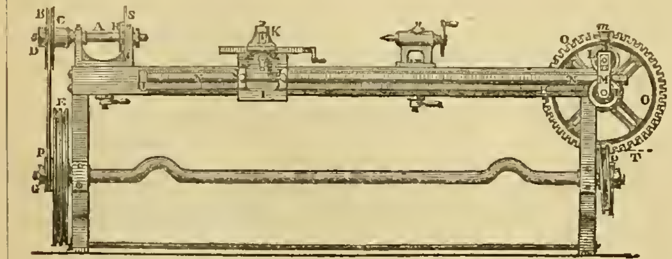
Then, what is attraction? Suppose one portion of the matter which energy has acted upon to undergo an atomic arrangement in consequence of the dominancy of one of the currents, it is evident that the flow of the current would be unimpeded, and that which repelled would now attract the former, and the flow of energy would follow the same course; thus, attraction and repulsion are only the material atoms impeding the primary flow of energy. On referring to the engraving, the arrangement of the particles forming distinct eliptical curves, convey to us an idea of lines of energy completing their current and returning to flow again in the same direction.

Paul Cameron.

SELF-ACTING LATHE.

According to promise, I send you a sketch of a self-acting lathe, which will enable an amateur to execute turning, planing, and drilling, with accuracy. The spindle of the lathe, A, runs in double bearings in the fixed head stock, and has the outer end prolonged for the purpose of carrying a change driving pulley, B, of any size which may be required. This pulley, B, is screwed up against a thick washer, C, on the spindle, by the nut, D; the fly-wheel, E, is fixed on the crank shaft of the lathe, outside the framing, instead of within it as is usual, and a pulley is screwed up to the fly-wheel, to correspond with the upper pulley by a locking nut, G, in the same way as of the pulley, B. A dovetail bar, N, is fixed to the front of the lathe bed, H, on which the slide-rest, I, traverses. The slide-rest carries the lateral and transverse slides surmounted by the slide-rest, K. L are two wheels, running on centres in the standard, M, which is bolted to the end of the lathe bed The upper wheel has a flat rim, and can be brought nearer to the lower wheel, which has an angular groove in its rim, by the pinching screw, *m*, which acts upon the sliding bush in the standard, M. The rod, N, which traverses the slide-rest, is flat on the top, flat-sided, and has an angular lower edge, fitting into the lower wheel, L. On the opposite end of the axis of this lower wheel, L, there is a worm-wheel fixed by a lock-nut. This worm-wheel, is driven by a tangent-screw, P, on the end of the fly-shaft.

In the illustration given, the parts of the lathe are shown arranged for heavy work, a large pulley, B, being on the mandrel, A, and a smaller one on the fly-shaft. For quick turning in wood, and light work, the washer, C, is removed, and the small pulley required is screwed up against the shoulder of the mandrel, so that this pulley will be in a plane with or over the fly-wheel. It will be seen that by using various sized pulleys many varieties of pitch may be cut. For drilling and boring, the tool revolves with the mandrel, and the work is held on the slide-rest, or on a saddle attached temporarily to the same. For planing and slotting, the work may be clamped to the lathe-bed, or be carried by the mandrel, which of course would be locked by the pointer, S, and dividing plate, R. By slackening the screws, J, the driving rod may be withdrawn from the slide-rest, and the worm-wheel, O, may be slid back out of gear with its tangent screw, by slackening the nut behind it. As the axial line of the tangent screw is considerably to the left hand side of the face of the worm-wheel, the latter being behind the lathe-frames, and the tangent screw centre in a line with the fly-shaft, the tangent screw gears into the worm-wheel, with the upper part of the slide, not visible in a front view, on a level with the dotted line, T.



Rochester, Oct., 1861. Thos. E. Merritt.

REVIEWS OF NEW BOOKS.

The Engineer's Hand Book. By Charles S. Lowndes, Engineer, Liverpool. 8vo., pp. 120. Wood Engravings. London: Longmans, 1860.

A practical book by a practical man, as we have reason to know Mr Lowndes to be, is so uncommon that we must look at it with becoming respect, as emanating from a source which must command the respect of practical men. In it the author has endeavoured, and with marked success, to lay before the young engineer the principles which should guide him in the construction of machinery, putting together, at the same time, the necessary rules and tables for the purpose, in a concise and intelligible form. The main points which he has taken pains to treat are "a rule for calculating the evaporative power of boilers:" "the comparative economical effect of using steam expansively;" and "the principles which regulate the speed of steam vessels."

We are glad to be able to say that simplicity pervades the volume throughout, and that the author has very properly seized, as illustrative lessons, the very things as to which the young engineer invariably finds himself in difficulties. The very first page of the volume will furnish a fair example of the author's subjects, and his mode of treatment of them, and we shall therefore quote from it.—

AIR PUMP.

Contents at least $\frac{1}{8}$ of that of cylinder, medium about $\frac{1}{6}$ of cylinder, occasionally $\frac{1}{5}$ of cylinder.

Air pump rod usually $\frac{1}{8}$ diameter of pump.

$$\left.\begin{array}{lll}\text{Cylinder diameter} & \times .5 & \text{gives } \frac{1}{8}\\ \text{``} & \times .575 & \text{``}\ \ \frac{1}{6}\\ \text{``} & \times .67 & \text{``}\ \ \frac{1}{5}\end{array}\right\}\ \text{When the stroke is } \tfrac{1}{2} \text{ that of the piston.}$$

For engines working with steam of 4 or 5 lbs. pressure, and for all engines where the pressure is reduced down to that of the atmosphere at the end of the stroke, $\frac{1}{8}$ of the cylinder's content will be found sufficient. For engines using steam of 10 or 12 lbs throughout, $\frac{1}{6}$ will be a proper size, but for engines working with a pressure of 20 lbs., and carrying their steam throughout, the largest size will be preferable. With these proportions the pump will be capable of lifting fully four times as much water as it will have to do to keep the condensor clear, as will be seen from the examples below.

For instance, take a cylinder 40 ins. diameter, 5 ft. stroke, at 20 revolutions per minute. This cylinder with 5 lbs. steam, $\frac{4}{5}$ full, requires 1 cubic foot water per minute, in the form of steam requiring 23·5 cubic feet water per minute to condense it being 24½ cubic feet of water to be removed by the pump every minute; pump 20 ins. diameter, 2 ft. 6 in stroke, $\frac{1}{8}$ capacity of cylinder, will lift 109 cubic feet per minute, being fully four times the quantity required.

Now take the same cylinder with 20 lbs. steam, $\frac{4}{5}$ full, the quantity of water required in the form of steam will be 1·76 cubic feet per minute, requiring 40 cubic feet of water to condense it; being 41.76 cubic feet of water for the pump to lift. If the pump is now made 26 ins. diameter × 2 ft. 6 in. stroke, equal $\frac{1}{5}$ content of cylinder, it will be capable of lifting 1·7 cubic feet per minute; being still above four times the quantity required.

Though this large size, in proportion to the work required, necessitates a considerable expenditure of power when the pump is being lifted up, a part of this force is restored to the engine during the first portion of the down stroke; and it is most probable that the benefit to the vacuum in the condensor more than compensates for the extra load on the engine.

The principal points to be observed in designing air or vacuum pumps.—Both foot and delivery valves should be as accessible as possible, and arranged so as to be removeable without interfering with the pump bucket. As small a space as possible should be allowed between the valves and the bucket, especially between the delivery valve and the bucket, when the latter is at the top of its stroke; for the bucket will always carry with it as much water as will fill this space, and the more water there is upon the bucket, the greater will be the obstruction to the passage of the hot air and steam (which it is partly the object of the air pump to remove), as these will have to be compressed until they are able to force a passage through the water on the bucket.

Air pumps for land engines usually of cast iron with cast iron buckets; delivery and suction valves with brass faces; valves of brass or india-rubber. Air pumps for marines, either all brass, or of cast iron lined with brass; buckets and valve seats, all of brass; valves, brass or india-rubber; rods, either of copper or composition; or for large engines, of wrought iron, with a shell of brass cast round it. The buckets for large pumps, instead of having one large valve, sometimes have a number of small valves, each about the diameter of the available space between the rod and the edge; when thus arranged, the valves are of a more convenient size, and even though one or two were to get out of order, the pump would still be able to do its work.

Size of valves or passages usually ¼ the area of pump.

It may be observed with respect to these, that the speed of the water through them should not be made to exceed 500 ft. per minute; that is, a pump working at a speed of 100 ft. per minute should have a clear area through its valves and bucket of at least ⅕ the area of the pump, and if working faster than this, the area of passages should be increased proportionably.

Double acting air pumps.—The efficiency of these depends principally on the position of the condensor, the bottom of which should be at least as high as the top of the pump, if it can possibly be so arranged.

We can commend this instructive passage to the close attention of the young engineer. It will give him a fair idea of what the author has got to tell him throughout the rest of his pages, which, unlike many other so-called guides, are really fraught with specific and direct information on the very subjects with which he must constantly deal.

MECHANIC'S LIBRARY.

Animals. Our Domestic, 6s, cloth. Gamgee.
Colours, On, new edition, fcp. 8vo, 5s, cloth.
Diamonds, Our Black, their Origin, Use, and Value, 2s, cloth. Plimsoll.
Education, Hints on Early, 17th edition, 12mo, 3s, cloth.
Exhibition of 1862, Buildings Designed for, 1s, sewed. Fowke.
Farm Buildings, Book of, royal 8vo, 31s 6d. Stephens & Burn.
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Gymnastics, Military, 8vo, 1s, sewed. Steinmetz.
History, Grecian, Guide to, 3d edition, 18mo. 3s 6d, cloth. Brewer.
Horse, The, Illustrated. 8vo, 18s Walsh & Lupton.
Illumination, Manual of. 8th edition, 12mo, 1s. Bradley & Goodwin.
Latin Language, Roots and Derivations. 9th edition, 4s 6d. Hall.
Machines. Mechanical Movements and Illustrations of, 3s. Burn.
Medicine, Manual of the Practice of, 2d edition, 12s 6d, cloth. Barlow.
Metaphysics and Logic, edited by Mansel & Veitch, 2d edition, 24s. Hamilton
Veterinary Directory, 1861, 12mo, 2s, sewed.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

In opening the business of the Section, the president (the Astronomer Royal), made some appropriate remarks upon the objects of the sectional meetings, and the mode of conducting its proceedings. The reading of the several papers on the list was then proceeded with:—

"Report on the Progress of Celestial Photography since the Meeting at Aberdeen," by Warren De La Rue.

Dr Robinson pointed out the advantages to science likely to result from these researches of Mr De La Rue; concluding by saying, that it would be shameful to allow the entire expense of the very costly apparatus required for producing the adjustments indispensable in these researches to fall on one individual; adding, that he had no doubt that, if the Committee of the Section would send forward to the Committee of Recommendations a request that a suitable sum of money be placed at Mr De La Rue's disposal for the continuance of those researches, that that request would be cheerfully complied with, and that Mr De La Rue would still afford what money could not purchase—his own invaluable superintendence and co-operation.—The Astronomer Royal, after heartily concurring in the suggestion of Dr Robinson, called the attention of the Section to the large photograph of the sun, and especially to the rapid shading off of the intensity of the light towards the outside of the sun's disc. He and the late M. Arago had differed on this very point,—M. Arago maintaining that the intensity of the sun's light must increase towards the edge of the disc, while he, the Astronomer Royal, ventured to maintain the contrary opinion. Here, by this very ingenious process by which Mr De La Rue had succeeded in photographing the sun's disc, it became palpable that his opinion was in accordance with the fact in nature; while that of M. Arago cannot any longer be maintained. The photographed fact settles the question.

"On the Distribution of Fog round the British Isles," by Dr J. H. Gladstone.

"On an Electric-Resistance Thermometer with Balancing Coil," by C. W. Siemens.

"On a Panoramic Lens," by T. Sutton.

This lens consisted essentially of a hollow sphere of crystal glass, inclosing water, with a central diaphragm and orifice, so managed as to give equal illumination to the centre and extremities of the panoramic picture, which was received on a screen concentric with the lens. Several photographic pictures taken by it were exhibited, and were entirely free from distortion of figure; what should be straight lines being accurately straight in the pictures, which were stated to extend to an angle of 120°.

Mr C. Brooke exhibited and explained the construction of the lens, which, he asserted, was rendered perfectly achromatic by a proper adjustment of the surfaces of the glass envelope and the central receptacle for the water. He also exhibited and explained the entire apparatus used with the lens in obtaining the photographic pictures or panoramic views of particular localities. Prof. Chevalier considered that, when the picture which was received on a concentric screen was spread out into a flat picture, the perspective could not be preserved. Mr Brooke admitted that, mathematically speaking, there was some distortion of the perspective, but it was so trivial as not at all to interfere with the general effect of the panoramic picture. The Astronomer Royal considered that the obtaining of panoramic photographs of scenes so accurate as those exhibited to the Section, and extending 120° round the observer, was a most important advance in the practical development of photography.

"Cases of Planetary Instability indicated by the Appearance of Temporary Stars," by D. Vaughan.

"Observations on the Structure of Copper, as seen with a Microscope," by W. Vivian.

The author, on looking at some broken pieces of pure copper, was at first inclined to consider the structure of the fracture as crystalline; but, on examining it with a microscope, he found this a mere appearance: the true structure being a multitude of minute cells communicating with each other, but separated by compressed diaphragms. He found a somewhat similar, but characteristically different, structure in the fracture of iron and other metals.

Mr Tomlinson, of King's College, London, read a paper "On Lightning Figures."

Mr Glaisher read the "Report of the Committee upon Luminous Meteors."

"An attempt to explain the Earlier Physical Conditions of Meteorites, as well as some of the Phenomena attending their fall on our Planet," by M. von Haidinger.

"Observations on the Preceding Communication," by R. P. Greg.

"On the Deposit of the Metal which takes place from the Negative Terminal of an Induction Coil during the Electrical Discharge in Vacuo," by J. P. Gassiot.

When the electric discharges by an induction coil are made from platinum wires hermetically sealed in a vacuum tube, as usually constructed, the wire which is attached to the negative terminal of the coil shortly assumes the appearance of being corroded; this arises from very minute particles of the metal having been disintegrated and separated from the wire, which particles are deposited on the sides of the tube in a lateral direction. If the wires are protected within the vacuum by being covered with glass tubing open at the end, but extending about one-eighth of an inch beyond the wire, it is the inside of this tubing that becomes coated with metal; but exclusive of this lateral action, a portion of the negative discharge will be observed to obtrude from the glass tubing in the form of a luminous brush; this luminosity is very sensibly affected by a magnet, and can in this manner be made to impinge on different parts of the vacuum tube, and wherever it is thus impinged heat is always evolved. The above phenomenon of the deflection of the negative discharge was described in a paper communicated by me to the Royal Society, and as I was subsequently desirous to examine with greater accuracy the nature of the deposit thus obtained from the negative terminal, and particularly if it could be obtained in the same manner from other metals than platinum, I had an apparatus constructed in which the discharge could be directed on slips of glass; the apparatus was also so constructed that wires of different metals could be inserted, and in this manner I succeeded in obtaining deposits of the following metals:—gold, silver, copper, platinum, zinc, iron, tin, lead, (brass), magnesium, tellurium, bismuth, cadmium, and antimony—for many of these I was indebted to Mr Matherson, who furnished them to me in a pure state. With gold, silver, platinum, tin, and bismuth, the deposit would take place in the state as now exhibited in about twenty-four hours' action; if the discharges were continued the deposit became denser, and, as will be observed, in one or two instances the centre is crystalline. With reflected light a large surface exhibits the lustre of the metal—with transmitted light the outer portion is transparent, showing the peculiar colour of the metals, as gold, green; silver, bluish-purple; platinum and tin, blackish-grey; tellurium, with the exception of antimony, I found disintegrated more freely than the other metals; while iron and magnesium were the most difficult; the deposit of the latter is scarcely perceptible. With aluminium wires I could not obtain any deposit after forty-eight hours' constant action; on one occasion I observed a faint trace on the glass, but in repeating the experiment with another wire no sign of any deposit could be obtained. Under the microscope the thin layer or deposit of metal is not resolved into any form, but appears as a mere film on the surface of the glass. From a brass wire terminal there was not any separation of the original metals. I had a tube constructed with two wires, both protected by glass tubing; a long slip of glass was inserted, so that the discharges from the + and the — terminals of the coil could be made with protected wires under the same conditions. The wires were of gold. The usual deposit took place at the negative; but after twenty-four hours' constant action not the slightest indication of any deposit from the + wire could be observed. With antimony a very peculiar effect was obtained; instead of the metal being deposited in a circular form, it spread nearly all over the glass and on the sides of the vacuum tube. I repeated the experiment by inserting slips of glass of sufficient length to reach beyond the terminals. Two of these glasses are on the table, and, if examined, it will be seen that the + discharge has apparently repelled the deposit as it formed from the negative wire, leaving a space somewhat analogous to the dark band which appears in the luminous stratified discharge. Whatever may be the cause of the difference in the action of the electrical discharge between the positive + and the negative —, the disruption of the particles of metal in the latter is merely mechanical; the minute particles are disrupted by the force of the discharge, which at the negative meets with resistance, and which resistance, under certain conditions, is attended with considerable heating effects, as if the wires are thin the negative invariably fuses, whether the discharges are made in air or in vacuo.

"On the Apparent Path of a Projectile, as affected by the Rotation of the Earth," by the Rev. Prof. Price.

This communication, though in its details eminently mathematical, yet conducted to conclusions, some of which had an important bearing on the directing of missiles discharged from some of those new guns which in some cases gave them destructive powers even at ranges of 10,000 yards, or nearly six miles. The author, after explaining to the mathematical part of his audience the symbols which he used and the successive integrations by which he arrived at the more general results, and the approximations by which these became so simplified as to be applicable to practical uses, these approximations chiefly depending on the very small fraction which expresses the angular velocity of the earth per second—a fraction which, when expressed decimally, has four ciphers after the decimal point before the first significant figure is arrived at, and whose square, therefore, and higher powers are too small to be of any practical value. He thus arrived at simple linear equations, which were easily integrated, and thus the path of the projectile obtained with sufficient exactness for all practical purposes. He selected two useful examples—one where the initial velocity was nothing, as in the case long ago investigated by Hooke, of a stone dropped from the hand into a deep mine, or from the top of a high tower, the path turning out to be a cubical parabola, showed a deviation to the east with a very small deviation to the south, from the point immediately beneath that from which it had been let drop, as actual experiment had determined it to be long since. The other example selected was that of a gun, directed due north or due south; in either case a westerly deviation being indicated, so that a gun of long range being directed exactly to its object the ball would never strike that object. He also stated, that at every rhomb along which the gun was directed a deviation peculiar to that point of the compass was indicated by the formula.

"On the Canonical Form of the Decadic Binary Quantic," by W. Spottiswoode.

"On Petzval's Asymptotic Method of solving Differential Equations," by W. Spottiswoode.

"Observations on the Production of Colour by the Prism; the Passive Mental Effect, or Instinct in comprehending the Enlargement of the Visual Angle, and other Optical Problems," by J. A. Davies.

"The Chromascope, and what it reveals," and "The Prism and Chromascope," both by J. Smith, were further observations and speculations on the power of producing the sensation of colour by the revolving rapidity of white cards, variously cut out on a black ground—say a piece of black velvet—in strong sunlight, first exhibited to the Section at the Aberdeen Meeting of the Association.

The author brought forward further evidence in favour of his optical theory, as opposed to the Newtonian, and combated the opinion that the effect of his Chromascope arose from the power of the retina to recover its sensibility to the impressions of differently coloured lights at successive times.

"An Experiment; being an Attempt to illustrate the Roseate Phenomena seen during a Total Eclipse of the Sun," by J. Smith.

The author considered that he had succeeded in producing the effect of the flame-coloured light seen during a total eclipse by causing a blackened circle to revolve rapidly in front of a strongly illuminated white circular card representing the sun.

"Provisional Report on the Magnetic Survey of Great Britain," by Gen. Sabine.

"On the Amount of Direct Magnetic Effect of the Sun or Moon upon Instruments at the Earth's Surface," by G. J. Stoney.

"On the Laws of the principal Diurnal Irregularities, Solar and Lunar, of Terrestrial Magnetic Forces as deduced from Ten Years' Observations at Greenwich, and on their Apparent Causes," by the Astronomer Royal.

The author described in an admirable manner, and suited to the comprehension of all present, what was meant by deviation and diurnal inequalities. Taking, he said, a compass needle or other bar of magnetized iron, if this were freely suspended it would take up a definite position as affected by the earth's attraction. Two forces pulled the needle, one towards the north the other towards the south. Its position, however, did not remain constant during the day, nor yet during the year; and it was of the utmost importance to register the deviations it made, either by the eye of an observer, or by the far more accurate method of self-registration. The latter method was employed at Greenwich, and was effected by causing a cylinder of sensitive paper to revolve once during the twenty-four hours; on this the beam of light reflected from the needle fell, and made a curved line on the sensitive paper. In a similar manner the amount of force pulling the needle north or south was registered; and thus the horizontal force acting on the needle endways and that acting sideways were rendered visible, and their changes, from time to time, calculated. The common daily disturbing force varied in different years extremely, from 1818 to 1857; and monthly also, for in June and July it was greatest, and in December and January least. This last observation led him to consider that it might depend a good deal on the radiation of the sun's heat, which was greater in summer, of course, than in winter. An interesting diagram was exhibited showing the law of this disturbing force, and consequent deviation of the needle during the day. It was greatest at noon, and decreased from that time till eleven at night, when it was least. The disturbance at the time when greatest tended in a south-westerly direction. He was inclined to explain the fact of this direction being taken from the consideration that Greenwich was peculiarly situated with regard to the distribution of land and water on the face of the globe. During the early hours of the afternoon, the sun, when on the north of the equator, was vertical over a great space of water lying in a south-westerly direction from Greenwich, the radiation from which was very great. Magnetism and galvanism were in his view interchangeable terms; and it was well known that it was difficult to get a galvanic current through the earth at any place on its surface when there was little or no moisture; and thus the sun shining before it reached the meridian of Greenwich on the arid plains of Central Asia, would have less magnetic effect than a few hours later in our day.

"On Spontaneous Terrestrial Galvanic Currents," by the President.

"On a Probable Cause for the Observed Diurnal Variation of Dip and Declination," by Prof. Hennessy.

"On the Quantity of the Acceleration of the Moon's Mean Motion as indicated by the Records of certain Ancient Eclipses," by the Rev. Edward Hincks.

"On the Secular Changes of Terrestrial Magnetism and their Connexion with Disturbances," by the Rev. H. Lloyd.

"On the Effect produced on the Deviations of the Compass by the Length and Arrangement of the Compass Needles," by A. Smith and F. J. Evans.

"On the Involution of Axes of Rotation," by Prof. Sylvester.

"On Curves of the Third Order," by A. Cayley.

"On Definite Integrals," by Bierens de Haun. M. de Haun has published several volumes of tabulated integrals.

"On Permanent Thermo-Electric Currents in Currents of One Metal," by F. Jenkins.

"On Binocular Lustre," by Sir D. Brewster.

"Report from the Balloon Committee," by Col. Sykes.

Prof. Walker, after the appointment of the committee at the Aberdeen meeting, having communicated to Col. Sykes his inability to undertake any active labours with respect to carrying out the objects for which the committee was nominated, Col. Sykes put himself into correspondence with Mr Langley, a gentleman of Newcastle, who offered to construct a suitable balloon, provided an advance of money were made to him. The correspondence, however, was without result, and Col. Sykes, in consequence, thought it unnecessary to invite the opinions of the other members of the committee with respect to the objects to be sought for in balloon ascents, as means were wanting, whatever those opinions might be, to give practical effect to them. Col. Sykes was not at the meeting at Oxford last year; and no action having been taken by the Balloon Committee, it has dropped through and is extinct. Within a few months past Mr Simpson, of Cremorne Gardens, has constructed a balloon at a cost of £600 (the Normandie), with a sufficient capacity to carry two persons to great heights, which might be available for the objects of the Association; the occasion has, therefore, arisen when the re-appointment of a Balloon Committee might take place; and as one of the chief objects of the last Balloon Committee—viz., the verification of the former results of the ascents undertaken by the authority of the Association—remains unchanged, Col. Sykes, with the approval of those members of the late Balloon Committee with whom he has an opportunity of conversing, will move the re-appointment of the committee, with a grant of £200.

"A Provisional Report on the Present State of our Knowledge respecting the Transmission of Sound Signals during Fogs at Sea," by Prof. Hennessy.

"On the Connexion between Storms and Vertical Disturbances of the Atmosphere," by Prof. Hennessy.

"On a Deep-Sea Pressure Gauge;" "On a Deep-Sea Thermometer;" "On a Daily Weather Map;" "On Admiral FitzRoy's paper presented to Section A, relative to the Royal Charter Storm;" and "On Some Meteorological Documents relating to Mr Green's Balloon Ascents," by J. Glaisher.

The deep-sea pressure gauge was a wide glass cylinder, terminating in a narrow, well-formed tube, the whole filled with water, and an elastic stopper, with an elastic ring below it, the entire enclosed in a brass case as to admit free access of the sea water, the pressure of which, in proportion to the depth to which it is sunk, compresses the water by about 22,750th part of its original bulk for each atmosphere of pressure or depth of about 34 feet to which it is sunk. The deep-sea thermometer is metallic; upon one end of a narrow plate of metal, rather exceeding a foot in length, are fixed three scales of temperature, ranging from 25° to 100° Fahr. Upon one of these scales the present temperature is indicated by the point of a needle, which turns upon a pivot in the centre; and on the other scale register, indexes are pushed by the needle, one to the maximum the other to the minimum temperature, where they are retained by friction. To the needle are attached, at equal distances from the centre, by connecting pieces, the free ends of two compensation bars, composed of brass and steel, riveted together, the other ends of the bars being fixed to the above-mentioned plate of metal. The other communications were abstracts made by Mr Glaisher, at the request of the Committee of the Section, of books lately published by Admiral FitzRoy, and kindly forwarded by him in time for the present meeting.

"On the Theories of Glacial Motion," by W. Hopkins.

"On the Great Cold of Last Christmas, and on its Destructive Effects," by E. J. Lowe.

"On the Compensation of Impressions moving over the Retina," by Sir D. Brewster.

"On Photographic Micrometers," by Sir D. Brewster.

"On the Bathometer, an Instrument to indicate the Depth of the Sea without submerging a line," by C. W. Siemens.

The sea-water being considerably less in density than the rocks which constitutes the crust of the earth, Mr Siemens showed by considerations derived from the integrals expressing the attractive force of any shell of the crust of the earth, that the depth of water under a ship must vary the total attractive force of the earth to such an amount as would become sensible to a very sensitive instrument. He, therefore, devised one consisting of a body of air inclosed in a strong glass cylinder made to support, by its elasticity, a column of mercury contained in a tube open at the bottom and dipping into it, kept at a uniform temperature by being surrounded by melting ice. The tube containing the mercury ends in a ball above, from which rises another tube and ball, the upper ball being still continued into a similar tube. Above the mercury, which rises to the middle of the lower ball, oil of juniper is put until it reaches the middle of the upper ball, and then coloured weak spirit is placed above the oil. The length of the column of mercury may be considered as a measure of the total gravitation of the earth, and the variations of this length are rendered very sensible by the differential apparatus, consisting of the two balls, and read off on a scale of about three inches length attached to the tube rising from the upper ball. The instrument hangs in the cabin of the ship. Her Majesty's Government were kind enough to send a vessel with the author and the instrument to the Bay of Biscay to make experiments with it, and its indication of the depth of water under the ship were found to be within less than ten per cent. from the truth as determined by the lead.

"On the Photographic Records given at the Kew Observatory of the great Magnetic Storm of the end of August and beginning of September, 1859," by B. Stewart.

The author remarked that the tendency of this great magnetic storm was to decrease the vertical and horizontal components of the earth's force, and that the disturbing force came in a wave, the period of which was seven hours. He contrasted this lengthened period with that of earth-currents, the period of which is only a few minutes, and supposed that the change in the earth's magnetism is due to the absolute amount of a disturbing force which is of a fluctuating character, and of which the fluctuations produce the earth-currents and Aurora Borealis, which are thus regarded as secondary discharges.

"On the new Minimum Mercurial Thermometer proposed by Mr Casella," by B. Stewart.

"Report on the Theory of the Exchanges of Heat," by B. Stewart.

The author gave a sketch of this theory from the time of Prevost, its founder, till the present day, describing in detail the successive extensions it met with from Leslie, Fourier, and Desains, and latterly from himself and from Prof. Kirchhoff. The great law insisted on was, that the absorption of a particle of any description of light or heat is proportional to its radiation; and it was shown how Prof. Kirchhoff applied this law to determine the constituents of the solar atmosphere.

"Report on Earthquake Wave Experiments," by R. Mallet.

"Report on the Theory of Numbers," by Prof. H. J. S. Smith.

"On the Optical Study of the Retina," by Sir D. Brewster.

"On the Application of the Principle of the Conservation of Forces to the Mechanical Explanation of the Correlation of Forces," by J. S. S. Glennie.

"On the Resistance of the Ether to the Comets and Planets, and on the Rotation of the latter," by J. S. S. Glennie.

"Contributions to the Report on Selenography," by W. R. Birt.

"Notes of Sketches of Parts of the Surface of the Moon," by Prof. Phillips.

"Meteorological Observations at Huggate, Yorkshire," by the Rev. T. Rankine.

"On the Deficiency of Rain in an Elevated Rain-Gauge as caused by Wind," by W. S. Jevons.

"Remarks on the Temperature of the Earth's Crust, as exhibited by Thermometrical Returns obtained during the Sinking of the Deep Mine at Dukinfield," by the President of the Association, W. Fairbairn.

"On the Causes of the Phenomena of Cyclones," by I. Ash.

"On a New Registering Anemometer," by Dr Morgan.

"On Standards of Measurement of Electrical Quantities and Resistances," by L. Clarke and Sir C. Bright.

"On British Rainfall," by G. J. Symons.

"On the Laws of Universal Storms," by W. Danson.

The author drew the attention of the meeting to the subject, important to all mariners, of the researches of Sir William Reid and Mr Espy, pointing out by the diagrams of their books the simple rules which should guide captains of vessels to know when a storm was approaching, how to prepare for its approach, and to escape with least damage when caught in one. He also exhibited and dwelt upon the practical value of a work called "The Sailor's Hornbook," by Capt. Piddington; drew attention to the leading points of Admiral FitzRoy's description of the Royal Charter Storm and other British storms; and concluded by giving some very interesting instances of vessels saved by attending to Sir William Reid's rules, and of vessels lost by neglecting them.

"Physical Considerations regarding the Possible Age of the Sun's Heat," by Prof. W. Thomson.

The author prefaced his remarks by drawing attention to some principles previously established. It is a principle of irreversible action in nature that, "although mechanical energy is indestructible, there is a universal tendency to its dissipation, which produces gradual augmentation and diffusion of heat, cessation of motion and exhaustion of potential energy, through the material universe." The result of this would be a state of universal rest and death, if the universe were finite and left to obey existing laws. But as no limit is known to the extent of matter, science points rather to an endless progress through an endless space of action, involving the transformation of potential energy through palpable motion into heat, than to a single-finite mechanism, running down like a clock and stopping for ever. It is also impossible to conceive either the beginning or the continuance of life without a creating and overruling power. The author's object was to lay before the Section an application of these general views to the discovery of probable limits to the periods of time, *past* and *future*, during which the sun can be reckoned on as a source of heat and light. The subject was divided under two heads:—1. On the secular cooling of the Sun; 2. On the origin and total amount of the Sun's heat. We do not know certainly that the sun is losing any heat at all, and it is certain that some heat is generated in its atmosphere by the influx of meteoric matter, and it is possible that the amount thus generated is so balanced as to compensate the loss by radiation. It is also possible that the sun is now an incandescent liquid mass, radiating away heat either primitively created or thus generated by the falling in of meteoric matter. From astronomical considerations. he showed that none of this matter can come from space beyond the earth's orbit; and by considerations derived from the disturbances of the inferior planets and the zodiacal light, the author had shown that the amount of meteoric matter could not be nearly enough to give a supply at the present rate for 300,000 years; and these anticipations have been verified by the recent researches of Le Verrier on the motions of the planet Mercury. Then, from further considerations connected with the motion of comets, he shows that this meteoric matter must be derived from spaces very near to the Sun. He then proceeds to estimate how much the Sun cools annually, and concludes that it cannot be more than 1°·4 centigrade annually. He then shows, from facts derived from various sources, chemical and astronomical, that the certain limits are entirely inconsistent with some of Darwin's geological estimates of time. Under the second head, the author shows that the statement which he first made still holds, with undiminished force, that meteoric action is not only proved to exist as a cause of solar heat, but it is the only one of all conceivable causes which we know to exist from independent evidence. The reasons for this are again given at length. And he concludes: it is, on the whole, most probable that the Sun cannot have illuminated the Earth for 100,000,000 years, and certain that it has not for 500,000,000; and as to the future, that the inhabitants of the Earth cannot continue to enjoy the light and heat necessary for their existence for many million years longer, unless some sources now unknown to us are prepared in the great storehouse of creation by Him who orders all things rightly and well.

"On Geometrical Nets in Space," by Sir W. R Hamilton.

"An Inquiry into the Fundamental Principles of Algebra, chiefly with regard to Negative and Imaginary Quantities," by C. F. Ekman.

"On Roots of Substitutions, by the Rev. T. P. Kirkman.

"On the Calculus of Functions, with some Remarks on the Theory of Electricity," by W. L. Russell.

"On the Symmetrical Form of the Properties of the Plane Triangle," by T. Dobson.

"On the Supposed Connexion between Meteorological Phenomena and the Variation of the Earth's Magnetic Force," by J. A. Broun.

"On Presentations of Colour under Novel Conditions," by T. Rose.

"On some Signs of Changes of the Weather," by the Rev. P. Walton.

"Remarkable Phenomena observed in the Sun at Nova Scotia," by H. W. Crawley.

"On the Cloud Mirror and Sunshine Recorder," by J. T. Goddard.

"On the Almanac," by M. N. Adler

"Observations on an Iris seen in Water near Sunset," by J. J. Walker.

"Method of interpreting some of the Phenomena of Light," by W. T. Shaw.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the ordinary monthly meeting of the Executive Committee of this Association, held at Manchester, September 24th, 1861, Hugh Mason, Esq., of Ashton-under-Lyne, vice-president, in the chair, Mr L. E. Fletcher, chief engineer, presented his monthly report, from which we have been furnished with the following extracts:—"During the past month the ordinary visits of inspection have been made, and the following defects discovered:—Fractures, 2; corrosions, 5; safety valves out of order, 3; water gauges ditto, 3 (1 dangerous;) pressure gauges ditto, 2; feed apparatus ditto, 1; blow-off cocks ditto, 7; fusible plugs ditto, 2; furnaces out of shape, 4 (1 dangerous;) over pressure, 11. Total, 40 (2 dangerous.) Boilers without glass water gauges, 6; ditto without pressure gauges, 6; ditto without blow-off cocks, 10; ditto without back pressure valves, 26. Two very serious explosions have happened during the last month, from which, in one instance, no less than eight lives were lost. Both of these explosions took place in London, and neither of the boilers in question was under the inspection of this Association. Owing to the large number of explosions which have lately happened—although not one of them, I am happy to say, has occurred to the boilers under the care of this Association—my remarks have been unavoidably very much confined to the details and causes of these events, and thus have had reference rather to questions relative to the "Prevention of steam boiler explosions" than to the "Effecting economy in the raising and use of steam." I have, however, for some time been anxious to state to our members the great economic advantage they would derive by the addition of *steam jackets* to their cylinders; and though these may be difficult to supplement to those already constructed, still our members are constantly laying down new engines when they could be introduced. The steam jacket was first applied nearly a hundred years ago, by James Watt; and in his original engine, which effected such a revolution in the use of steam, it was one of the fundamental principles, and for it a special claim was made in his patent. With the exception of the Cornish Pumping Engine, which has for years maintained a character for great economy, the steam jacket has been neglected by Watt's successors, who thereby have only made a step in the wrong direction, and I think that this step has been made partly from motives of the most mistaken economy, and partly from the fact of the action of the jacket not having been correctly understood, so that, even when it has been applied, its construction has, in most cases, been so defective as to completely neutralise its advantages. The late Dr Haycroft, of Greenwich, was, I believe, one of the earliest to discover and publish wherein the secret lay of the virtue of the steam jacket. He showed that it did not lie in preventing loss on the *outer* surface of the cylinder by radiation, as had been generally supposed, but in the prevention of loss on the *inner* surface from condensation and re-evaporation, caused by the alternating communication of the cylinder, with the boiler at a high temperature and the condenser at a low one. On the introduction of steam to the cylinder, condensation takes place, and a coat of dew is formed on the whole of its internal surface; and on the communication with the condenser being made by the opening of the exhaust port, this coat of dew is re-evaporated, thereby considerably cooling the metal of the cylinder. On the re-introduction of the steam on the return of the stroke another deposit of dew is made to atone for the heat abstracted by the re-evaporation already referred to, and thus a process of alternate condensation and re-evaporation is set up, which keeps pace with every stroke of the engine, and is destructive of all economy, since by it a considerable percentage of steam passes through the engine from the boiler to the condenser, without doing any work; thus indicator diagrams do not correctly give the amount of steam used, and measurements of the quantity of water evaporated in the boiler show that a large proportion of the steam supplied to the cylinder of the engine is entirely unaccounted for. This action can only be arrested by maintaining the cylinder at as high a temperature as the steam which enters it, the most practical way of effecting which is found to be the use of James Watt's original steam jacket. A great stride in economy has recently been made in Marine Engines, one of the most important elements in the attainment of which has been the steam jacket, and without this it has been found that it is utterly futile to attempt to realise the full economic duty of high pressure steam worked expansively, although with low pressure steam, carried throughout the whole stroke, the jacket is not so necessary. I lay these particulars before our members to give them the advantage of the experience of other departments of engineering, and wish that such of them as have steam jackets fitted to their cylinders, would co-operate with me in thoroughly testing their result, that the information may be diffused throughout the whole Association. One of our members reports to me, that from a jacket of only partial extent, a saving has been effected of 12½ per cent. In conclusion. To economy of fuel an economical use of steam is essential, which can only be attained by a high degree of expansion, and this cannot be beneficially exercised without the steam jacket.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

October 1st, 1861.

A letter from Dr Fairbairn, F.R.S., &c., tendering his resignation of office as one of the Vice-Presidents of the Society, having been read, it was moved by Mr Spence, seconded by Mr J. A. Ransome, and unanimously resolved, "That the Members of the Literary and Philosophical Society express their regret that Dr Fairbairn feels it necessary to resign his Vice-Presidentship of the Society, and hope he will still continue to favour them with his presence and his valuable contributions as formerly."

Dr Schunck announced to the meeting that Messrs Spence; Roberts, Dale, and C.; Tennants and Co., and others had, at his request, presented to the Society a portion of the beautiful products which had formed part of the interesting Exhibition in the Laboratory of Owens College during the late Meeting of the British Association.

"Observations of Comet I, 1861," by Mr Baxendell, F.R.A.S.

Although this comet was not at any time a very conspicuous object to the naked eye, yet some of the features which it presented when viewed with a good telescope at the time of its greatest brightness were sufficiently remarkable to render it an object of peculiar interest to the astronomer.

The first observation was made on the night of May 3rd, 1861. The comet was then already visible to the naked eye as a dull, hazy-looking star of the 4½ magnitude. At 10h. 17m. 48·7s G.M.T. a comparison with the star *Arg.* 178,8=190,112 made with the equatorially-mounted achromatic of 5 inches aperture, and a dark field photographed micrometer constructed by Mr Dancer, gave the comet's apparent place R.A. 10h, 5m. 27·76 Dec. 48° 52′ 7·7″. Turning the 13-inch reflector upon the comet with powers of 81 and 196, it was found that the nebulosity was more than 20′ in diameter, considerably condensed in the middle, but without any distinct planetary or stellar nucleus. There was a faint tapering elongation extending about a quarter of a degree from the north following side, and stars of the 11th and 12th magnitude were easily seen through the comet at the distance of half a radius from its centre.

Mr Baxendell, referring to the photographed mircometer which he had alluded to in his paper, remarked that, at the late Meeting of the British Association, Sir David Brewster read a paper suggesting the application of photography to the construction of micrometers for astronomical purposes, but he did not appear to be aware that a micrometer prepared in that way had actually been constructed and in use for some years. The idea of employing photography for this purpose had apparently occurred to different persons, independently of each other, but the credit of having been the first to reduce this idea to practice belonged, Mr Baxendell believed, to Mr Dancer, who, in the early part of the year 1858, furnished him with a micrometer consisting of a system of cross lines, neatly photographed on a small glass plate, which by a proper adapter could readily be placed in the field of view, in a plane perpendicular to the axis of the telescope and with the collodion side of the plate next to the object end of the instrument. He had since had this micrometer in constant use for differential observations, and the results he had obtained were quite as satisfactory as any that could be obtained by the more elaborate and expensive reticle micrometers in ordinary use.

Some remarks having been made by Mr Atkinson and Mr Vernon respecting the vibrations of the barometric column which frequently take place during gales of wind, Mr Fryer stated that, with a view of ascertaining whether the barometer was subject to minute oscillations inappreciable by the ordinary method of observing, he had placed an aneroid barometer under the microscope, using the quarter-inch object glass, and by bringing one of the striæ on the surface of the steel index into focus, he was able, by means of the micrometer, to observe a movement of the 20,000th of an inch. The index appeared to be in constant motion, but at present he was not prepared to lay any set of observations before the Society. Mr Fryer also suggested, for the same purpose, the use of a barometer filled with the oleine of olive oil, such an instrument being free from the disturbances caused by the watery vapour present in the water barometer and exhibiting a greater range.

SCOTTISH SHIPBUILDERS' ASSOCIATION.

October 7, 1861.

The second meeting of the present session of the Scottish Shipbuilders' Association, was held in the Queen's Rooms this evening—Mr Barclay, of Messrs Barclay & Curle, in the chair. Mr Mansel, of Messrs Napier & Sons' shipbuilding establishment, read a paper, "On the analysing and comparing the power of ships."

MONTHLY NOTES.

MARINE MEMORANDA.

Our Coasting Trade.—During the month of August last, 12,738 vessels, 1,500,000 tonnage, entered inwards; and 13,157 ships, 1,477,341 tonnage cleared outwards. In the corresponding month of 1860 the numbers were—ships 12,906, tonnage 1,492,416; and ships 14,144, tonnage 1,518,968.

As regards the Shipping Trade, we find that in the same month, there were 3,231 vessels employed in the Foreign Trade, with a tonnage of 974,524, entered inwards; whilst in the corresponding month of 1860 the number was 3,591, with a tonnage of 934,905. There cleared outwards during the same periods respectively, 4,704 ships, 1,063,000 tonnage, whilst in the corresponding month of 1860 there were 4,998 ships, 1,147,945 tonnage.

Launch.—On the 26th ult., from the yard of Mr William Pile, North Sand, Sunderland, a fine modelled iron screw steamer, of the following dimensions:—Length 170 feet, breadth 27 feet, depth 15 feet 6 inches, and 600 tons O.M., classed nine years, the property of Thomas Richardson, Esq., of Hartlepool.

Shipbuilding at Liverpool.—The amount of tonnage at present in construction at the shipbuilding yards on both sides of the Mersey is at present about 2,000 tons, builders' measurement, taking steam and sailing vessels together. Of this total about 22,500 tons is being built of iron, and 5,500 of wood. Messrs Laird's works at Birkenhead have the lion's share, and amongst the vessels there constructing are an iron plated frigate of 6,700 tons and 1,200 horse-power, and an iron screw transport of 2,800 tons for the British Admiralty.

Coast Defences.—A party of workmen under the direction of Mr Twigg, the government contractor, are employed laying down Colquhoun's improved system of raised racers for the 68-pounder and 10-inch guns mounted on the martello tower commanding the entrance to the river Medway. As soon as the alterations to the guns on the tower have been completed the principle will be immediately applied to the whole of the 10-inch and 68-pounder guns erected on the other portions of the fortifications, the Ordnance Select Committee have reported so favourably on the invention that the Government intends applying it to most of the heavy guns mounted on the leading positions along the coast.

The Samphire.—This vessel is one of several which the London, Chatham, and Dover Railway Company are about to place between Dover and the Continent. She is of 160 nominal horse-power. Her engines, have been constructed by Messrs Ravenhill, Salkeld, and Co., are fitted with oscillating cylinders of 50 inches diameter, with 3 feet 9 inches stroke. The cylinders are placed on the fore and aft lines of the vessel, and are at an angle to each other; the paddles are feathered; the boilers are tubular, and at a pressure of 25lb the revolutions of the paddles are about 48. At the trial trip, at the measured mile she made 16 47 knots, and on one of her double successive runs her rate against the tide was a mean of 16.649 knots, or nearly 19¼ statute miles.

H.M.S. Defence.—The Admiralty having directed the iron screw steamer *Defence*, 22, to be fitted with Cunningham's patent self-reefing topsails, the invention is now being fitted to the yards and masts under the superintendence of the patentee. The fore and main yards for the *Defence* are each upwards of 90 feet in length, and weigh four tons each. The fore and main topmasts are 55 feet in length, which is somewhat less than is usually carried by vessels of similar rating. The *Defence*, however, will trust more to her lower masts, which are to be of wrought iron and of great strength and weight. It was originally intended to mast the *Defence* before she was docked, but as every effort is to be made to get her to sea as quickly as possible, no time is to be lost in completing her; and her iron lower masts not having yet arrived at Chatham, it is decided that she shall not wait for them. About a hundred additional shipwrights are employed in completing her internal fittings.

Ventilation of Ships.—Messrs Silver and Moore have patented a new method for ventilating the between decks of ships. This they have managed by opening trap-valves in all the decks below the spar deck. These apertures are protected by the insertion of a round iron grating. The valves under the decks spread the air or gases, and help in the down-draught, and they are made self-acting, so as to close in the event of water filling the compartments of the hold, and thus stop its passage above the lower deck. To carry off the gases and all foul air from the hold, pipes are let down through all the decks to within a few feet below the lower deck. The upper parts of these pipes are conically shaped to create a current of air. The gases are carried up naturally by this up-draught, and pass away above the bulwarks. By this simple contrivance the patentees maintain that they can keep the between decks free from impure air and foul smells, for, as the pure air passes down the hatchways, it carries with it the gases to the hold, and thence by the up-pipes to the spar-deck. The smell from bilge water and offensive cargo are considerably lessened by this mode of ventilation. The principle, we understand, is about to be adopted in France, in theatres and hospitals.

S.S. China.—Messrs. Napier and Sons launched from their building-yard at Govan on the 8th ult., the finest screw steamer which the Clyde has yet produced. This vessel, which is named the *China*, is intended as a complement to those fine vessels which are already on the Cunard line. The launch was most successfully completed, notwithstanding the disagreeable weather. The *China* is a ship of 2,600 tons burden. She is to be fitted with oscillating engines of 550 nominal horse-power and patent surface condensers, in addition to the ordinary condensers. The Cunard Company have always exhibited the greatest caution, combined with the highest enterprise, in constructing the vessels intended for their line; and in the present case we have an instance of a vessel fitted up with all the most recent improvements, and yet to provide for the smallest chance of an accident—having on board not only the condensers on the new system, which has generally been adopted to the discarding of the old plan, but those also founded on the former system. This is only an additional proof to the many which have already been given of the great care and attention which the Cunard Company have always paid to the building of their famous line of steamers. The dimensions of the *China* are: length of keel and fore rake, 322 ft.; breadth (moulded), 40 ft.; depth (moulded), 29 ft; and extreme length, 346 ft.

The Eclipse, 4, screw steam sloop, 700 tons, had recently a trial of her engines previously to their being passed over to the Government authorities by the contractors. The vessel is fitted with horizontal air-pump trunk engines, 200-horse nominal power. She was tried at full and half-boiler power, with the following results:—With full boiler power she attained an average speed of 10½ knots; revolutions, 98; pressure of steam, 20; vacuum, 25; draught of water aft, 10 feet 8 inches; forward, 8 feet. With half boiler power she attained a speed of 9·274 knots, 76 revolutions. She was also tried at turning the circle, which was accomplished in 4 min. 5 sec., and the half-circle in 2 min. 30 sec. Common screw pitch, 16 feet; diameter, 11 feet. During the trial, which lasted seven hours, the Eclipse was under the command of Captain Schomberg, chief of the steam reserve at Sheerness. Mr W. Price, Inspector of Machinery Afloat, with Mr S. Townsend, Foreman of Engineers, Sheerness dockyard, was in attendance on the part of Government. Mr Brown, foreman to Messrs R. Napier and Son, of Glasgow, had charge of the engines, and represented his employers. The trial was very satisfactory, but would have been much more so had it not been for the foulness of the bottom of the ship.

Messrs Rennie, the Thames engineers, are just now completing two enormous floating docks for the Spanish naval arsenals. Each dock consists of large rectangular pontoons, divided into several water-tight chambers, or compartments, but united as a whole. The dimensions of the base in the dock now made are 350 feet long, 105 feet in breadth, and 12 feet 6 inches in depth, the total displacement being somewhat over 13,000 tons, and capable of lifting vessels of at least 7,000 tons. On the longer sides of the base are constructed hollow walls, the outside being perpendicular, and the inside with shoring steps such as are in ordinary graving, or dry docks; but they differ from them in having no walls at one end, or gates at the other, both ends being open, so that the length of the vessel to be docked is not of so much consideration as its weight. The mode of docking a vessel is very similar to that of the ordinary process. After the water has been found to be of the required depth to float in the vessel that is to be docked, she is warped in and placed over the keel blocks, and shored up as the water leaves her sides; but this water (namely, that occupying the space between the sides of the vessel and the dock), instead of either being pumped out or allowed to run out as the tide falls, is displaced in consequence of the whole dock and vessel being raised bodily out of the water. This is done by means of engines and pumps placed in the side wall, and as soon as the vessel is properly placed the water is pumped out of the chambers or compartments forming the rectangular base, until the vessel is sufficiently above the level of the water to permit her being repaired.

After all the mishaps with which the *Great Eastern* has met, a better fate is now said to be in store for her. The Emperor of the French, it is said, contemplates purchasing her for use as a transport. Should this eventuate in truth, it is more than possible that she will at last be turned to good account. A thousand ton screw steam-ship, the *Askalon*, has just been launched by Messrs Scott & Co., of Cartsdyke, Greenock, as a consort to the two screws, the *Plantagenet* and *Talisman*, engaged in the West India trade. She is to be fitted with engines of 150 horse power, by the Greenock Foundry Company. To Messrs Napier & Sons now belongs the credit of having produced the finest screw steamer yet sent out of the Clyde. Considerable interest was excited on the occasion of the departure from Liverpool to New York, within a few days of each other, of the *Great Eastern*, the *Persia*, paddle steamer belonging to the Cunard Company, and the *City of New York*, a new screw steamer belonging to the Inman line, and considerable speculation existed as to the probable length of their respective passages. The *Persia's* passage involved 10 days, 16 hours, and 40 minutes; and that of the *City of New York* 12 days, 23 hours, and 15 minutes. These passages lead us to conclude that the weather in which the *Great Eastern* was disabled was nothing unusual at this season of the year in the North Atlantic; for the passage of the *Persia* on this occasion is only eight minutes less than the average of her September and October passages since she first began running, while the passage of the *City of New York* is two hours and 46 minutes less than the average September and October passages of the screw steamer *City of Baltimore* (belonging to the Inman line) during the past two years.

New Life-Boat at Southport.—Situated on one of the most dangerous parts of our western coast, Southport, Lancashire, has long been in want of a first-class life-boat, so that the numerous fishermen living in its vicinity might be on an equality with their fellow-mariners on other portions of the coast. This desideratum has at length been supplied, and through the noble generosity of James Knowles, Esq., of Eagley Bank, Bolton, Southport now possesses as trim and perfect a little vessel as any of her neighbours can boast of. It is one of the National Life-boat Institution's new double banked boats, 32 ft. long, 8 ft. wide, and 3 ft. 9 in. deep, carrying ten oars, two short masts with lug sails, and is fitted up with every improvement, her cost having been about £200. The boat was christened by Miss Knowles, daughter of the donor, and named the "Jessie Knowles," and was launched amid the deafening plaudits of the multitude. The boat slid from off its carriage and shot into the foaming tide. There was a glorious sea, just suited for the occasion; a tremendous nor'wester blew an unusually high tide right upon the beach, dashing the waves about right gloriously. Universal admiration was expressed at the majestic style in which the "Jessie Knowles" bounded away on the crests of the fiercest waves with apparently the buoyancy of a cork. The crew, who were all provided with the new life belt invented by Captain Ward, were delighted with her performances, and under his direction pulled about the bay for nearly two hours, passing round and under the new Iron Pier, and receiving from the enthusiastic crowds that witnessed her evolutions expressions of the highest approbation. At length she was brought in to shore and safely sheltered in the new boathouse, which has been built for her accommodation at a cost of £15. The National Life-boat Institution has now 115 boats under its charge on various points on all parts of the coast, and is worthily carrying out a mission of the highest importance, which deserves the assistance and encouragement of every lover of his species.

MISCELLANEOUS.

Northern Railway of France.—The traffic receipts on 605 miles of this company's line from the 1st of January to the 30th of September last amounted to 1,786,596*l.*, and for the corresponding period of last year to 1,724,199*l.*, showing an increase of 62,406*l.*, or 3·62 per cent.

Aerated Bread.—The machinery for the manufacture of aërated bread has at length, it is stated, been rendered sufficiently simple and inexpensive to be adapted to the working of small bakeries, and proposals have accordingly been issued for a general letting of the patents. Strong allegations are still made as to the economy of the process, and Sir J. Liddell, the Director-General of the Medical Department of the Navy, has just given favourable testimony with regard to the quality of the bread produced. He states decisively that the bread now supplied under the aërated system, is very far superior to that furnished at any previous time. So much for Dr Dauglish's Invention.

The Revenue.—The returns for the year and quarter ending Sept 30, show a net decrease on the quarter of £2,056,934, and on the year of £1,003,817. The increase shown in the quarter arises from Customs, £94,000; Post-office, £70,000; and Crown Lands, £911. The decrease is in Excise to the amount of £868,000; Stamps, £40,000; Taxes, £6,000; Property Tax, £1,290,000; and Miscellaneous, £17,845. Upon the year the increase is in Customs, £91,605; Stamps, £158,192; Property Tax, £823,184; Post-office, £100,000; and Crown Lands, £2,911; whilst a decrease is exhibited in Excise to the extent of £1,446,000; Taxes, £127,000; and Miscellaneous, £607,429.

South Austrian Railway.—The total receipts on 1,004 miles of Railway from the 1st of January to the 30th of September last amounted to 1,588,850*l.*, against 1,160,305*l.*, on 687 miles for the corresponding period of last year, showing an increase of 428,545*l.* The total receipts on the Lombardo line for the same time, on 156 miles of railway, amounted to 180,914*l.*, against 157,663*l.*, on 139 miles in the corresponding period of 1860, showing an increase of 23,251*l.* The total receipts on 91 miles of the Central of Italy branch from the 1st of January to the 30th of September amounted to 106,803*l.*, and for the corresponding period of 1860, on the same mileage to 91,837*l.*, showing an increase of 14,963*l.*

A Foundry Swallowed up by a Coal Mine.—An extraordinary occurrence took place recently at West Bromwich. The engineer at the West Bromwich Foundry had scarcely entered the works in the morning when he perceived a peculiar movement of the earth beneath his feet, and almost instantly ascertained that the land on which the engine and works were placed was about to fall into an abyss created by some old workings in an adjoining coalpit. The man's first impulse was to save himself from the impending danger, and he had no sooner run out of the engine-house than the earth gave way with a fearful sound, swallowing up in its downward course the steam-engine and machinery. A large boiler attached to the engine was left behind among the *débris*, where it remained for some time in an insecure position. The escape of the engineer, the only man then on the premises, was most miraculous.

Apple Juice for Fixing Dyers' and Printers' Colours.—Our dessert dishes and our cyder casks are this year labouring under a difficulty of a very peculiar nature, a great scarcity in the supply of apples has actually arisen from a severe competition for them by dyers and printers, who have at length found that apple juice affords an excellent means of fixing colours on cotton fabrics. Prices have risen in Devonshire some fifty per cent., and the fruit merchants have now everywhere a difficulty in obtaining even meagre supplies at high prices for current use. It is a pity that acid of sufficient value is not obtainable from some cheaper and less useful source.

GRAND TRUNK OF CANADA.—The traffic receipts of this company for the week ending September 28 amounted, for local passengers, to 30,161 dols., for foreign passengers to 7,347 dols., for emigrants to 675 dols., for mails, &c., to 3,319 dols., for local freight and live stock to 29,044 dols., for timber and lumber to 2,061 dols., for firewood to 1,079 dols., and for foreign freight and live stock to 5,903 dols.—total, 79,589 dols., against 80,963 dols., showing a decrease of 1,374 dols. The total traffic receipts from the 1st of July to 28th of September amounted to 768,257 dols., and for the corresponding period of 1860 to 802,626 dols., showing a decrease of 34,369 dols., or 4·28 per cent.

MELBOURNE AND HOBSON'S BAY.—It appears that the traffic receipts on this company's line, five miles in length, for the week ending the 15th of July, amounted to £1,427, against £1,270, for the corresponding week of 1860; for the week ending the 1st of August to £1,821, against £1,965; for the week ending the 8th of August to £1,435, against £1,145; for the week ending the 15th of August to £1,270, against £1,423; and for the week ending the 22d of August to £1,169, against £1,340 for the corresponding week of 1860. The total receipts for the five weeks amounted to £7,122, including £3,292 for goods, &c., against £7,143 for the corresponding period of last year. The receipts for monthly tickets are included in the first week's return of each month. The total traffic receipt averages for the five weeks, £284 per mile per week.

COTTON IN JAMAICA.—The advices continue most favourable. The agent of the Cotton Company had put in 22 additional acres since the last packet sailed. The Egyptian seed, which the company sent out by steamer, had turned out very good, and was in fine growth. Some of the cotton planted in May was putting forth blossoms. The Governor was about to plant 40 acres on his estate, adjoining that which the company's agent had planted and was continuing to plant. The season for planting continued favourable, and there was no want of labour. The crop of corn planted with the first cotton was ripening fast, and would soon be stored. The covering of the cobs would serve for making paper-pulp, and, together with the wasting plaintain and other fibres with which the island abounds, would yield a supply for papermakers in large quantity. A great number of small settlers had obtained some of the Egyptian seed sent out by the company, and, although discouraged by some of the local newspapers, large quanties of cotton had been planted in all parts of the island.

CANADIAN TRADE.—If the disastrous state of affairs in the Western Continent is acting prejudicially to those interested in trade with the United States, of which there is no question, our Canadian friends appear to be reaping the benefit of it. By the *Hibernian* we are advised, by a comparative statement, official, of the arrivals and tonnage of the ships arriving at the port of Quebec, up to the 7th of September, that 993 ships of an aggregate tonnage of 590,162 tons had arrived during the present year, against 824 ships and 456,904 tons in the corresponding period of last year, an increase of 169 in the number of ships and 133,258 tons in the aggregate tonnage, or upwards of one-fourth in the present year. The coasting trade (or as it is termed "the lower ports") has also improved in a similar ratio. Up to the 7th of September, 1861, 104 ships of 9,644 tons having arrived at Quebec against 52 ships and 6,104 tons in 1860, an increase of 52 ships and 3,540 tons, or upwards of one half, when compared with last year. The trade of Montreal has more than doubled itself during the present year. The number of ships entered inwards up to the 5th instant being 301, of an aggregate tonnage of 157,906 tons against 114 ships and 61,267 tons in the same period of 1860, an increase of 187 in the number of ships and 90,639 tons.

IRISH MINES.—The principal products of the Irish mines are sulphur, lead, copper, and coal. The General Mining Company has commenced to work zinc from their silver mines in Tipperary. Iron exists in the country in large quantities, but the available supply of coal is not sufficient to carry on the operations with respect to this ore. Last year the Wicklow Sulphur Mines yielded 107,000 tons of ore, employing 1,200 hands, representing a mining population of 5,000, the average earnings being 15s. a-week for miners and 10s. for labourers. The principal copper mines are Knockmahon, in the county of Waterford, and Berehaven, in Cork. The ore is exported and smelted in England. In 1859 they yielded 10,859 tons, value £108,107; persons employed, 1,370; amount of wages for the year, £45,000. The lead mines of Glendalough produced 1,814 tons. The lead mining population is 1.500, who receive in wages £14,000 a year. In 1859 the mines of the Seven Churches yielded 12,650 ounces of silver, value £3,480. The coal mines are generally not more than 3 or 4 feet in thickness, chiefly anthracite. There are 45 collieries altogether, 35 in the south and 10 in the north. In 1857 the quantity raised was—bituminous, 42,150 tons; anthracite, 78,250; in all 120,400; value at 8s per ton, £48,000. At the recent examination in practical chemistry held at South Kensington, when pupils from 22 schools of England and Scotland competed, four out of six medals given were carried off by pupils from the Primary School of Chemistry in Cork.

OUR EXPORTS AND IMPORTS.—The total declared value of Exports for the month last past is £12,337,441, whilst for the corresponding month of 1859 and 1860 they were respectively £12,117,275 and £13,535,205. The total importation of Coffee for the month in 1861 was 8,776,391 lb., against 6,536,032 lb. in the corresponding month of 1859, and 9,010,055 lb. in 1860, whilst in the same period there were entered for home consumption respectively 2,827,230 lb., 2,583,071 lb., and 2,844,379 lb. Unrefined sugar shows an importation of 1,334,286 cwt. for the month of the present year; whilst for 1859 and 1860 the figures stood respectively, 1,005,435 cwt., and 1,022,118 cwt.—the quantities taken for home consumption during the same period being, for 1861, 846,434 cwt.; for 1859, 420,485 cwt.; and 1860, 790,180 cwt. In Wines of various descriptions the importation for the month of August last amounted to 743,380 gallons; for the month in 1859-1860 they were respectively 610,829 gallons and 1,114,851 gallons. The quantities entered for home consumption in the same periods were—1861, 757,189 gallons; 1859, 602,443 gallons; and in 1860, 699,329 gallons. Of Spirits, including rum, brandy, and geneva, there were imported during the month of the present year 1,025,772 gallons; for the corresponding month in 1859 and 1860 the figures were 1,065,229 gallons and 671,389 gallons. The quantities taken for home consumption during the same periods were 395,131 gallons, 355,093 gallons, and 389,820 gallons respectively.

THE NEW FRENCH TREATY.—"According to Act. 15 of the Treaty of Commerce concluded on the 23d of January, 1860, between France and England, the new Tariffs which were to be established on the importation of merchandise of British origin and manufactures were applicable as follows:—1. For coal and coke, from the 1st of July, 1860. 2. For iron, cast iron, and steel not prohibited, from the 1st of October following. 3. For works in metal, machinery, tools, and mechanical articles of all kinds at a date not later than the 31st of December, 1860. 4. For yarn and fabrics of flax and hemp from the 1st of June, 1861. 5. For all other articles from the 1st October, 1861. The goods enumerated in the first four categories of Act 15 of the treaty were, at the dates indicated, imported into France at the new duties fixed by the supplementary conventions concluded between France and England. But it is from the 1st of October, 1861, that according to the tariff determined by those conventions, and by the Treaty of the 1st May, 1861, between France and Belgium, the merchandise of English and Belgian origin previously prohibited, such as the greater part of woollen and cotton yarns and tissues, cutlery, carriages, earthenware, &c., has been admitted into France. Previously to the 1st of October certain quantities of these sorts of merchandise were sent to the entrepôts of Paris and of some other large towns, and to facilitate the payment of duties at that date the necessary documents had been prepared in advance on the declarations of the senders after a serious examination and control of those declarations. Merchandise of English and Belgian origin was accordingly introduced without delay from the day fixed for the execution of the treaties, and the following is an account of the duties levied on the merchandise introduced into Paris and the principal towns of France from the 1st to the 5th of October:—Paris, 759,903f duties on 3,474,235f, the estimated value of merchandise (the 759,903f include 177,523f duty levied on merchandise taxed by weight, and of which the precise value has not been ascertained;) Lille, 50,551f duties for 256,372f value; Rouen, 36,803f for 191,891f value; Lyons, 25,255f for 141,469f; Bordeaux, 14,377f for 70,996f; Marseilles, 13,347f for 27,131f; Mulhausen, 7,477f for 11,207f; Jeumont, 1,011f for 10,113f; and Havre, 865f for 5,361f. The total duties were 907,576f on a declared value of 4,188,778f."

SIR WILLIAM CUBITT.—Sir William Cubitt, F.R.S., the eminent engineer, died on Sunday last, after an illness which for some years had prevented him from following his profession. He was in the 77th year of his age, having been born in 1785, at Dilham, in Norfolk. In early life he assisted his father, who carried on the business of a miller; but, quitting this occupation, he was apprenticed to a joiner. In his new employment he soon acquired the character of a first-class workman, and became especially skilled in making agricultural implements. Not long afterwards he adopted the trade of a mill-wright, and obtained ample employment in the erection of machinery. In 1807 he promulgated his invention—which has since become so commonly adopted—of the self-regulating windmill sails. Shortly afterwards he became connected with Messrs Ransome & Son, the celebrated agricultural implement makers of Ipswich. Messrs Ransome's business extended beyond the mere manufacture of agricultural instruments; and, accordingly, Mr Cubitt was extensively engaged in the construction of gas-works. In connection with prison discipline his name will ever be remembered as the inventor of the treadmill, which has since been introduced into nearly all of her Majesty's gaols. The innovation, however, did not take its place amongst the institutions of the country without being subjected to a large amount of ridicule and opposition. The first treadmill was erected at Brixton gaol in 1817. In 1826 Mr Cubitt settled in London as a civil engineer, and immediately was engaged in works of the most important character. In 1827 an act was passed for the improvement of the Norwich and Lowestoft navigation, and Mr Cubitt was appointed engineer. The object was to open a navigation for sea-going vessels from Yarmouth or Lowestoft to Norwich. To effect this, Mr Cubitt united the river Ware with the Waveney, thence to the small lake of Oulton Broad, through Lake Lothing, with a passage onward to the sea, 700 yards long and 40 wide—Lake Lothing being thus formed into an artificial harbour, the tide-lock of which will admit vessels 84 feet long and 21 feet in beam. This undertaking was completed in 1829. Among his subsequent employments he designed the South Eastern Railway, including the removal of the South Cliff by blasting, which feat was accomplished under his superintendence. He was officially appointed, being then President of the Society of Civil Engineers, to exercise a superintending watchfulness over the construction of the building for the great Exhibition of 1851, in Hyde Park. He received the honour of knighthood for thus contributing his scientific experience in carrying out this national undertaking. The last great works upon which Sir William Cubitt was engaged were the two large floating stages in the Mersey at Liverpool, and the new iron bridge across the Midway at Rochester.

THE CENSUS IN AMERICA.—As the exact and official returns of the Census are being made public, we behold more clearly the precise march and direction of the population which has been filling up, during the last ten years, the unoccupied territory of the Union. Its grand and main course is westward, with some currents to the north-west and some to the south-west. The flood of population over some of our new States in the far West has probably never been equalled in the history of emigration, both in the character of the emigrants and in the number placed upon new soil, where before were the animals of the prairie and the forest and the roving Indian. Minnesota, for instance, increases from 6,077 inhabitants in 1850 to 162,022 in 1860, or at a rate of increase of over 2,500 per cent.; Oregon, from 13,294 to 52,464, or at the rate of 294 per cent.; Iowa, from 192,214 to 674,948, or at 251·22 per cent.; Texas, from 212,592 to 602,432, or 183·37 per cent.; Wisconsin, from 305,391 to 775,873, or 154·06 per cent. Arkansas increases 107 per cent., and Illinois over 100 per cent. The average rate of the growth of population in all the States the last decade is 35·02 per cent. There are 19 States below this average, the lowest in order being Vermont, 0·32 per cent.; then New Hampshire, 2·55 per cent.; and next South Carolina, 5·28; Maine following with 7·73, and Tennessee with 11·68, and once powerful Virginia with only 12·27, while North Carolina shows only 14·23. There are 11 States counting 19,528,555 inhabitants, or an average of more than one million and a half each—namely, Illinois, Indiana, Ohio, Pennsylvania, Massachusetts, New York, Tennessee, Missouri, Virginia, Kentucky, and Georgia. In territories the greatest advance is, of course, in Utah, or 254·07 per cent. In new Mexico it reaches 51·98. The black current must always be the important one to the statistician of this continent. The Census reveals a steady stream of negroes from the seaboard towards the south-west. Virginia retains her old pre-eminence as the breeder of slaves for market, in which noble occupation she is apparently closely followed by South Carolina, while the States whither this disgusting traffic tends are Arkansas, Mississippi, and especially Texas. The average increase of the slaves is moderately large, or 23·42 per cent. There is a loss in but two States, Delaware (of 21·48 per cent.) and Maryland (3·52). The increase in Virginia is only 3·88 per cent., and in South Carolina 5·28—this small advance evidently resulting from exportation. Kentuckey, too, shows an increase of but 4·87 per cent. the last decade, which gives a most gratifying prospect of the destiny of the system in Kentucky, as it is believed no very important numbers have been exported during the last ten years from that State. North Carolina only exhibits an advance of 14·74, and Tennessee of 15.17 per cent. Missouri presents a larger increase than was expected—namely, 31·51. The great increase is in Texas, where it reaches over 210 per cent. (210·66); in Arkansas it is 135·89, and in Florida, 57·09; in Mississippi, 40·73. In two States only are the slaves more numerous than the whites—in South Carolina, where they number 402,541, against 291,623 of the white inhabitants, and in Mississippi, being 436,696 to 353,969 whites. Their largest number in any one State is in Virginia (490,887), and the next in Georgia (462,232). In the territories there are 10 slaves enumerated in Nebraska, 24 in New Mexico, and 29 in Utah. The district of Columbia shows a loss of slaves of 13.72 per cent. Among the free coloured population the increase is very small through the Union—only 10·68 per cent. Their largest numbers are to be found, as usual, in Virginia, Maryland, and Pennsylvania. Little valuable in a statistical point of view is to be extracted from the tables of this population, as the diminution from banishment or emigration cannot be distinguished from that arising from natural and regular causes. The theory sustained recently by an able statistician in Washington (Mr Weston), that the free negro inevitably diminishes on this continent, is not yet sufficiently confirmed by facts to be admitted as a satisfactory scientific hypothesis. The race undoubtedly dies out in climates not adapted to it—as, for instance, in the Northern States; but whether it decays in freedom in the middle or southern latitudes does not yet fully appear. In many of the Southern and Western States there are laws expelling the free negroes, and their decrease observed in those States during the last decade may be due to those extraneous causes. Their largest increase in a slave State is in Georgia (18·01 per cent.); in Alabama, 16·11; in Maryland, 12·04; the greatest decrease in Arkansas, 77·47. Greatest increase in a Free State, in Minnesota, 487·18 per cent.; in New York they lose 2·18 per cent.

HIRSCH'S SCREW PROPELLER.—The form of the propelling surface, as delineated in Fig. 1 of the accompanying engravings, may be best understood by considering it projected in section. First, on a cylindrical surface consecutive with the axis; and secondly, on a plane perpendicular to the axis. I. The cylindrical projection is a curve, the entering edge of which is inclined to the plane of revolution at such an angle that it coincides with the resultant of the vessel's velocity forwards, combined with the circumferential velocity of the blade at that distance from the axis where the section is taken, while the back or leaving edge of the blade is inclined somewhat more to the plane of revolution, or coincides with the resultant of the vessel's velocity, plus slip combined with the circumferential velocity of the blade. From this curvature it results that the blade, as it passes through the water, gives every particle that meets its surface a gradually increasing velocity backwards, and thus receives a constant reactive pressure forwards over its whole surface, without producing sudden shocks or breaking the water into foam. II. The projection of any section of the blade on a plane perpendicular to the axis, is an archimedean spiral. Every point of the surface is thus inclined to its radius at such an angle, as to overcome a great part of the centrifugal force which would be given to the water by blades radiating in straight lines from the centre. The backwater from the propeller is thus rendered less broken or divergent, and consequently more directly reactive in propelling the vessel forwards, and more effective on the rudder for giving ease and rapidity of steering. The effect of the combination of the two curvatures is to extend the propelling surface of the blades over a greater portion of the circle of rotation, and so to divide its action on the water as to make the impulse smooth and gradual, and obviate almost entirely the vibration resulting from straight-bladed propellers. Fig. 2, represents a section through the middle of a propeller, supposed to be made by a plane at right angles to the axis; fig. 3 is a sectional plan through the middle of the boss on the line marked 1, 1, on fig. 2; and fig. 4 is a sectional plan on the line marked 2, 2, on fig. 2; fig. 5 represents portions of the details. A, is an inner boss, which may either be bored, as represented, to receive the shaft of the propeller, or may form a portion of the shaft, each side of this boss A, is made conical, or it may be spheroidal round an axis at right angles to the axis of the propeller, so as to be of greatest diameter at its middle, and to taper in either direction from the middle; B, are portions of two blades, each blade terminating in a hemi-spheroidal boss, or it may be a semi-conoidal boss, which is hollowed out, so as to fit accurately on the tapering portion of the inner boss A, so that when the two blades are placed upon this inner boss, they can be firmly tightened on its tapering surfaces. Two bolts, C, are made to pass through both bosses, recesses being formed at each side of the inner boss A, to let them clear it, each of these recesses being wider than the bolt, so as to allow of its passing a little on either side of the central line; the head of each bolt is fitted into a recess formed in each blade, and is shaped off to the form of the blade boss, and the point of each bolt is screwed and fitted with a washer *c*, and nut. A recess is formed in each blade to admit the nut and washer, and to afford sufficient room round the nut for admitting a socket wrench to tighten or slacken the nut when required. And each of these recesses is elongated in one direction to permit of the bolt and nut occupying a position a little on either side of the central line. Each of the bolts is made of such a length that the nut stands somewhat above it when fully tightened, and a wedge-shaped piece, D, is placed in each recess, so as to lie upon the surface of the nut, and over this is fitted another wedge-shaped piece, E, the outer surface of which is shaped off to the curvature of the blade when it is driven tightly into the recess, and each of those pieces is secured in its place by a screw, F, entering into it from the back surface of the blade. When it is desired to alter the pitch of the blades, or to change the angle which any portion of their surfaces makes with the axis of the propeller the screws, F, are removed, the pieces, E and D, are removed from the recesses, a socket wrench is introduced into the recesses so as to slacken the nuts, and the blades are turned partly round upon the tapering surfaces of the inner boss, A, to the required position; the nuts are again tightened, and the pieces, D and E, and their screws, F, are again inserted. When it is considered desirable to fix the blades at a particular pitch, and to provide additional security against their shifting during work, the washers, *c*, are made to fit the recesses in which they lie, and several spare washers are provided with bolt holes through them bored more or less out of the centre line, as represented on fig. 5. When one of these washers having the bolt hole in its suitable position for the required pitch is introduced into each recess, the bolt and blade are retained in the same relative position to one another, even if the nut be slackened.

Fig. 1.

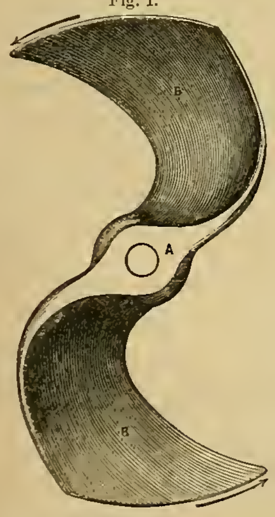


Fig. 2.

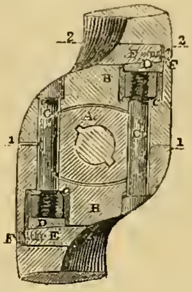


Fig. 3.

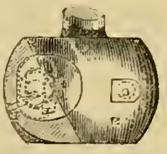


Fig. 4.

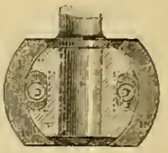
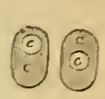


Fig. 5.



APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

6th September, 1861.

2232. William Wild, Bury, Lancashire—Certain improvements in machinery or apparatus to be employed in the preparation of cotton and other fibrous materials for spinning, called "Slubbing frames and roving frames."

2233. Edward Harrison and Thomas S. Yates, Oldham, Lancashire—A certain compound or certain compounds to be used as a substitute for gunpowder.

2234. Michael Henry, Fleet Street—Improvements in the means of signalling on railways.—(Communication from Mr Vincenzi, Parma, Italy.)

2235. Thomas G. Messenger, High Street, Loughborough, Leicestershire—Improvements in glazing horticultural buildings, the roofs of railway stations, and other erections.

7th September, 1861.

2236. Ephraim Taylor, Blackburn, Lancashire—Improvements in obtaining motive power.

2237. William Ainsworth, Ellis Heap, William Fielding, Eli Openshaw, Adlington, Lancashire—Certain improvements in power looms for weaving.

2238. Nicholas D. P. Maillard, Dublin, Ireland—Improvements in the material and preparation of the material and apparatus for making potash, pearlash, and caustic potash of commerce.

2239. John Carpendale and Thomas Middleton, Sheffield, Yorkshire—A machine to produce raised chasing on copper, silver, and Britannia metal by the application of pressure.

2240. George Norris, Brondesbury Terrace, Kilburn—Improvements in the manufacture of soap.

2241. Joseph Holland, Manchester, and George Okell, Ashton-under-Lyne, Lancashire—Improvements in apparatus by which an engine or train is made to give an alarm or signal at any required place on arriving at or passing any given point on the railway.

2242. Herbert Redgate, Nottingham—Improvements in machinery for the manufacture of skirts usually called crinoline skirts.

2243. Robert O. White, Blackheath Park, Surrey—Improvements in the manufacture of bricks.

2244. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in the construction of saddles.—(Communication from Mr Louis Friese, Stuttgard, Wurtemburg.)

9th September, 1861.

2245. George Malcolm, Dundee, Forfarshire—Improvements in machinery or apparatus for softening or treating jute, hemp, flax, or other similar fibrous substances.

2246. William Simons, Renfrewshire—Improvements in or connected with ships or vessels.

2247. William Dowell and James Dowell, Rhyl, Flintshire—A new or improved motive power engine.

2248. Patrick B. O'Neill, Hart Street, Bloomsbury—Improvements in screw wrenches or spanners.

2249. Alfred Fryer, St. Anne's Retreat, Sutton, Lancashire—Improvements in propellers and in propelling vessels through water.

2250. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in fire grates and furnaces for domestic and other purposes.—(Communication from Paul Baudet, Paris.)

2251. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery or apparatus for making cigars.—(Communication from Albert Reiniger, Stuttgart, Wurtomburg.)

2252. Charles Cheyne, Great George Street, Westminster—Improvements in extinguishing fires in buildings, and in apparatus employed therein.

2253. Richard A. Brooman, Fleet Street—An improved method of producing mixed coloured woollen and other threads.—(Communication from Stanislaus Vigoureux, Reims, France.)

2254. William E. Newton, Chancery Lane—An improvement in the construction of boots and shoes.—(Communication from Joseph L. Joyce and Edward Heaton, Newhaven, Connecticut, U.S.)

10th September, 1861.

2255. John Anthony, Oxford Terrace, Poplar—Improvements in steam boilers and generators.

2256. Thomas S. Tyson, Leeds, Yorkshire—A lubricator applicable to corves or waggons.

2257. James Smith, Sadlors Place, London Wall—Improvements in sewing machines.

11th September, 1861.

2258. Leon P. Barré, South Street, Finsbury—Improvements in tubular steam boilers.

2259. Richard Restell, Croydon, Surrey—Improvements in the means of connecting and disconnecting engines and tenders to and from trains.

2260. William L. Thomas, Hill Street, Berkeley Square—Improvements in projectiles.

2261. John Bowns, Earlstown, Warrington Junction, Lancashire—Improvements in railway wheels and railway breaks.

12th September, 1861.

2262. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in needles.—(Communication from Thomson H. Alexander, Washington, Columbia, U.S.)

2263. John A. Dauncey, Manchester—Improvements in the manufacture of gloves, collars, and wristbands to be worn as articles of clothing.

2264. William Stevens, Godolphin Road—Improvements in mechanism or apparatus for ploughing and cultivaing of the land by steam and other power.

2265. Charles Greaves, Old Ford, Bow—Improvements in apparatus for preventing waste of water from service pipes or cisterns.

2266. Archibald Turner, Leicester—Improved apparatus for enabling the guards and drivers of railway trains to communicate with each other.

2267. Marc A. F. Mennons, Rue de l'Echiquier, Paris—An improved combination of machinery for the production of Valenciennes, Chantilly, Brussels, and other similar laces.—(Communication from Jean F. R. Laporte, Rue St. Fiacre, Paris.)

2268. Marc A. F. Mennons, Rue de l'Echiquier, Paris—An improved combination of chemical and mechanical processes for the conversion of fibrous vegetable matters into paper pulp.—(Communication from Louis A, Carteron, Dieuze.)

2269. William W. Clay, Nottingham—Improvements in knitting machinery.

2270. William E. Gedge, Wellington Street, Strand—Improvements in the nautical compass.—(Communication from Grégoire L. Ripamonti, Bordeaux, France.)

13th September, 1861.

2271. Joseph Oliver, Longtown, Cumberland—Improved machinery for making bricks, pipes, and tiles.

2272. William Davis, Snow Hill, Birmingham, Warwickshire—The prevention of accidents arising from affrighted horses.

2273. William Farlar, Turnham Green—Improvements in sash fastenings, which improvements are also applicable to other purposes.

2274. William H. Delamare, Clarence Place, Hackney Road—An improved machine for purifying and peeling corn.

2275. Paul Dubrule, Tourcoing, France—Improvements in weaving, for manufacturing figured or ornamented stuffs with treadle power looms.

2276. Robert Smith, Weymouth Cottage Hornsey, Benjamin Brooks, Albert Terrace, York Road, King's Cross, and James Smith, Oak Villas, Wood Green, Tottenham—Improvements in the construction of roof and other lights.

2277. George C. Haseler, Vittoria Street, Birmingham, Warwickshire—Improvements in lockets.

2278. Richard Fell, Kingsland—Improvements in compressing and rarefying atmospheric air, with machinery for applying the same to obtain a motive power, part of which is applicable for cooking purposes.

2279. Richard A. Brooman, Fleet Street—Improvements in machines for weighing and measuring corn and other grain.—(Communication from Joseph A. A. Catenat, Lyons, France.)

2280. Thomas L. Murray, Paris—Improved appplications of mica previously coloured or metallized to various useful purposes.—(Communication from Frederic Holthausen, Paris.)

2281. Joseph B. Howell, Sheffield, Yorkshire—Improvements in the manufacture of chains and chain cables.

2282. Charles Sutton, Salford, Lancashire—Improvements in indicating the position of sunken ships or other such vessels.

2283. Henry Dixon, Pendleton, and John R. Renner, Liverpool, Lancashire—Improvements in carbonizing saw dust and other vegetable substances.

2284. William E. Newton, Chancery Lane—Improvements in guns.—(Communication from William M'Cord, New York, U.S.)

14th September, 1861.

2285. George Dixon, Wood Street—Improvements in the manufacture of upholsterer's trimmings.

2286. John A. Knight, Symonds Inn, Chancery Lane—An improved apparatus for rendering fatty or oleaginous matter, and delivering the same.—(Communication from Wellington Lee, New York, U.S.)

2287. William H. Crispin, Marsh Gate Lane, Stratford, Essex—Improvements in the manufacture of curved and angular paper tubes and pipes.

2288. Richard Waller, Baker Street, Portman Square—Improvements in machinery or apparatus for manufacturing and refining cane juice and other saccharine substances.

2289. William Wheatstone, Conduit Street, St. George's, Hanover Square—Improvements in concertinas and other musical instruments, the tones of which are produced from the vibration of springs.

2290. James Led, Widnes Dock, near Warrington, Lancashire—Improvements in self-acting signals for railways.

2291. James King and John Sutcliffe, Rochdale, Lancashire—Certain improvements in or applicable to machines for spinning and doubling.

2292. Frederic Barnett, St. Mary Axe—Automatic electric signals to prevent collisions on railroads and railways.

2293. Marc A. F. Mennons, Rue de l'Echiquier, Paris—An improved surgical instrument applicable to the treatment of certain diseases of the urethral, vaginal, nasal, and other passages or cavities of the human body.—(Communication from Salvator Vinci, M.D., Rue de la Pepiniere, Paris.)

2294. Alfred Green and William H. Glover, Stourbridge, Worcestershire—Improvements in the manufacture of vice boxes.

2295. Henry C. Jennings, Great Tower Street—Improvements in treating hides and skins.

2296. George Hawksley, Three Mill Lane, Bromley, by Bow—Improvements in traction and locomotive engines.

2297. William E. Newton, Chancery Lane—Improved apparatus to be adapted to carriages for the purpose of checking or arresting their progress on inclines or when going down hill.—(Communication from William G. Caporn, Sydney, New South Wales.)

2298. Timothy Morris, Robert Weare and Edward H. C. Monckton, Trafalgar Square—Improvements in batteries for obtaining electric currents and the products therefrom.

2299. Thomas Webb, Artillery Terrrace, Victoria Street, Westminster—Improvements in tills or receptacles for money.

16th September, 1861.

2300. Samuel Horsley and Edward H. Jones, Liverpool, Lancashire—Improvements in apparatus for cleaning and polishing boots, shoes, and other coverings for the feet, partly applicable for cleaning plate and other articles of domestic use.

2301. Martin Rae, Manchester, Lancashire—Improvements in lamps.

2302. William E. Gedge, Wellington Street, Strand—Improved apparatus for drying grain.—(Communication from Casimir Druart, Passage des P. Ecuries, Paris.)

2303. John Reeves, London—Improvements in electro-magnetic engines for obtaining and applying motive power.

2304. Thomas Meriton, Second Bernard Strasse, Saint Pauli, Hamburgh—Improvements in steering apparatus.

2305. William J. Hesketh and David Parsell, Saundersfoot, Pembroke—Improvements in steam boilers and furnaces whereby better to adapt them to burn all kinds of coal, more especially anthracite or stone coal.

2306. William Clark, Chancery Lane—Improvements in the application of mica to ornamental and other purposes.—(Communication from Messrs Louis A. A. Cavenne and Frederic Holthausen, Boulevart St. Martin, Paris.)

2307. George Ery, Great Portland Street—Improvements in sights for rifles and other fire-arms.

2308. William Stewart, Peckham, Surrey—Improvements in apparatus for supporting persons in and for enabling them to progress through the water.

2309. Arthur M. Skinner, Belfast, Antrim—Improvements in propelling ships' boats and other vessels.—(Communication from Colonel Philip K. M. Skinner, Poonah, India.)

2310. Richard A. Brooman, Fleet Street—Improvements in apparatuses for stretching, supporting, and uniting telegraph wires.—(Communication from Charles Pougnaire, Marseilles, and Joseph S. Bourcy, Paris.)

2311. Richard A. Brooman, Fleet Street—An improvement in shirts.—(Communication from André F. E. Robert, Paris.)

2312. Frederic M. Ransome and Ernest L. Ransome, Ipswich, Suffolk—Improvements in treating stone, bricks, and other surfaces, and in the manufacture of filters.

2313. Weston Tuxford, Boston, Lincolnshire—Improvements in thrashing machines, and in raising and stacking straw and other agricultural produce.

17*th September*, 1861.

2314. Bernhard Samuelson, Banbury, Oxfordshire—Improvements in harvesting machines.

2315. Francis Wrigley, Manchester, Lancashire—Improvements in the construction, manufacture, and mode of securing armour for the protection of ships and fortifications against projectiles.

2316. Frederic Barnett, St. Mary Axe—An improvement in the light given by street and other lamps by means of reflectors in white earthenware, china, and all enamel materials, in conjunction with an improved chimney to draw up the exhalations and smoke of all lighting materials.

2317. John Eastwood and John B. Joyce, Bradford. Yorkshire—Improvements in machinery or apparatus for combing wool and other fibrous substances.

2318. Frederick J. E. A. G. d'Olincourt, Rue de Flandre, Paris—A new system of cultivating land, and for preventing the disastrous effects of inundations.

2319. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in machinery or apparatus for the manufacture of horse-shoe and other nails. —(Communication from Charles A. Souvrier, Paris.)

2320. Joseph Statham, Salford, and William Statham, Openshaw, Lancashire—Certain improvements in machinery or apparatus for mowing and reaping.

2321. Joseph Lee and Benjamin D. Taplin, Lincoln—Improvements in traction engines.

2322. Albon H. Bailey, Boston, Massachusetts, U.S.—An improved system of combination types, and an improved case for containing the same.

18*th September*, 1861.

2323. George White, Pancras Lane—Improvements in apparatus for filtering or purifying water or other liquids.—(Communication from Mr Burq, Paris.)

2324. Joseph G. Briggs, Earl Street, Blackfriars—Making fire-proof buildings, ships, and other constructions.

2325. William Cory, jr, Coal Exchange—Improvements in vessels and machinery for unloading colliers and other vessels containing coals.

2326. Edward. A. Coeper, Great George Street, Westminster—Improvements in apparatus for freeing gases from dust and other particles of matter floating therein, and for causing vapours or gases to be absorbed by liquids.

2327. Henry Wickens, Tokenhouse Yard, Bank—Improvements in reaping and mowing machines.—(Communication from Nicholas Coones, London, Canada, America.)

2328. Edward Partington, Heap Bridge, Lancashire—Certain improvements in machinery or apparatus employed in the manufacture of paper.

2329. Alfred J. Beer, Canterbury, Kent—Improvements in the valves of steam and other motive engines.

2330. George Ferry, Hoxton—An improved anchor.

2331. Edmund Suckaw and Edward Habel, Manchester, Lancashire—Improvements in machinery or apparatus for opening and cleaning cotton and other fibrous materials.

2332. John Gurman, Onslow Road, Southampton, Hants—Improvements in the fittings and method of hanging window sashes to facilitate their removal for cleaning and other purposes.

19*th September*, 1861.

2333. Louis G. A. Condroy, Douai, France—An improved centrifugal apparatus, intended for purifying, washing, drying, moulding, or extracting from liquids, substances or materials of various kinds, which are deposited or poured for this purpose in moveable baskets or boxes fitted in the said apparatus.

2334. James Clough, Bolton-le-Moors, Lancashire—Certain improvements in machinery for preparing cotton or other fibrous substances.

2335. James C. Coombe and James Wright, Bridge Street, Blackfriars—Improvements in the manufacture of stones, bricks, tiles, slabs, statuary, and such like materials, and in the method of and means for cleansing and indurating the same when employed in buildings or for building purposes, and for preserving them from atmospheric and other influences.

2336. James Durrant, Granville Terrace, Lewisham, Kent—An improved form of coal box, combining within itself a cinder sifter, an ash and dust pan, and receptacles for other requisites connected with domestic fire stoves.

2337. Charles W. Eddy, Chester Terrace, Regent's Park, St. Marylebone—Arming the bow of a ship of war with a shell and a beak to be fitted or unfitted at pleasure, and to be used conjointly or separately.

2338. Edward Clark, Chatham Street, Liverpool, Lancashire—Improved means or apparatus for preventing accidents on railways.

2339. Edgar Breffit, King William Street—An improved fuel.

2340. William Clark, Chancery Lane—Improvements in machinery for the manufacture of fishing and other nets.—(Communication from Messrs Felix M. Baudouin, Achille Baudouin and Jean E. F. Jouannin, Boulevart St. Martin, Paris.)

2341. William T. Tongue and John Greer, Liverpool, Lancashire—An improved portable self-acting water-engine for extinguishing fires and other purposes.

2342. John H. Wilson, Liverpool, Lancashire—Improvements applicable to pumps.

2343. Thomas Silver, Philadelphia. U.S., and Thomas Moore, Regent Circus, Piccadilly—Improvements in the construction of and appliances to steam ships or other vessels.

2344. John Graham, Ann Street, Devonport Street, Commercial Road East—A double acting force or lift pump for ships, fire-engines, and other purposes.

2345. Samuel Hawksworth, Doncaster—Improvements in the manufacture of floor cloth and in ornamenting other surfaces.

2346. Angelo J. Sedley, Regent Street—Improvements in metallic bedsteads and sofa bedsteads.

2347. René P. P. Dagron, Paris—An improved microscope to be used for exhibiting photographic views and productions.

2348. Theophilus Redwood, Montague Street, Russell Square—An improvement in the manufacture of paper.

20*th September*, 1861.

2349. Thomas M. Gladstone, Parliament Street, Westminster—An improvement in the construction and form of anchors.

2350. Brooke Smith, Birmingham, Warwickshire—Improvements in taps and cocks.

2351. John Oliver, Colchester, Essex, John Grantham, Nicholas Lane. William Sinnock, Sylvan Cottage, Woodford, Essex, and Montague R. Leverson, Saint Helen's Place—Improvements in the mode of obtaining certain chemical substances, and in the treatment of vegetable fibre, and in obtaining manurial and other products therefrom.

2352. Henry Walter and David Johnstone, Manchester, Lancashire—Improvements in castors.

2353. Joseph C. Davidson, Yalding, Kent—Improvements in thrashing machines.

2354. Charles Perman, Salisbury, Wiltshire—Improvements in machinery or apparatus for cultivating land.

2355. James Burnand, Netherthorpe Street, Sheffield, Yorkshire—Improvements in the means of fastening or securing the handles of table knives and forks, daggers, and other similar articles, part of which invention is also applicable to ladles.

2356. George Roberts, Bessborough Place, Pimlico, and Frederick Lambe, Cushion Court, Old Broad Street—Certain improvements in lamps and lamp wicks, whereby they are adapted for more effectively burning animal, linseed, and other heavy and also glutinous and bituminous oils, and other burning fluids employed for illuminating purposes.

2357. William G. Creamer, Woburn Place—Improvements in railway brakes, and in apparatus for actuating the same.

2358. George T, Bousfield, Loughborough Park, Brixton, Surrey—Improvements in machinery for combing cotton and other fibrous material.—(Communication from Cullen Whipple, Providence, and Rufus Stafford, Smithfield, Rhode Island, U.S.)

2359. Francis W. Wymer, St. Ann's Row, Newcastle-on-Tyne—Improvements in apparatus used in sounding the holds of ships or vessels.

2360. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in machinery for manufacturing shoes for horses and other animals.—(Communication from Edward A. Cutler, Providence, Rhode Island, U.S.)

21*st September*, 1861.

2361. Louis R. Bodmer, Thavies Inn, Holborn—Improvements in gasaliers and in ventilating apparatus connected therewith.

2362. Charles Board, Bristol—Improvements in veneering presses.

2363. Henry and Francis C Cockey, Somersetshire—Improvements in apparatus employed in the manufacture of gas.

2364. James Fenton, Low Moor, Yorkshire—An improved method of causing the water to circulate in steam boilers.

2365. William Stahleford, Oldbury, Worcestershire—Improvements in the manufacture of wheels, and in securing tyres on or to wheels.

2366. Alexander Parkes, Birmingham, Warwickshire—Improvements in the manufacture of casting rods, bars, bolts, nails, rivets, and sheets when alloys of copper are used.

2367. William Tongue, Bradford, Yorkshire—Improvements in machinery for combing, heckling, and dressing fibrous materials.

2368. Spendlove Desborough, Noble Street, St. Martin's le Grand—Improvements in the manufacture of pins for hair, dress, jewellery, and other purposes.

23*d September*, 1861.

2369. James H. Dunley, Northamptonshire—An improvement in the manufacture of axle boxes and bushes.

2370. Charles Stevens, Charing Cross—Improvements in the manufacture of steel and in the hardening of metals.—(Communication from Joseph T. L. Rousselot, Paris.)

2371. Hippolyte Plantrou, jr., Passage des Petites Ecuries, Paris—Improvements in washing and scouring wools by the introduction of air into the water, using an aeriform washing apparatus.

2372. Jabez Kenyon, Blackburn, Lancashire—Improvements in the treatment of yarns or warps previous to their being sized.

2373. Heury Brinsmead, Ipswich, Suffolk—Improvements in apparatus for raising and stacking straw and other agricultural produce.

2374. Viucent Jankowski, Princes Street, Fitzroy Square—Improvements in carriages.

2375. Alfred A. Hely, Forest Hill, Surrey—Improvements in the construction of portable fire-arms.

2376. James Price, Dundalk, Ireland—Improvements in the permanent way of railways.

2377. Joseph Jacob, Golden Square—Improvements in the mode of and apparatus for obtaining and treating gas, and the application thereof to various purposes, parts of which improvements are applicable to the manufacture of iron and steel.—(Communication from Carl Preisenhammer and Carl Weniger, Zöptau, Austria.)

24th September, 1861.

2378. James D. Parkes, Parliament Street, Westminster—Improvements in the propeller of a ship.—(Communication from Jean B. Vincent, Rue Ferdiuand du Temple, and Martin L. Goupy, Rue St. Georges, Paris.)

2379. William E. Wiley, Great Hampton Street, Birmingham—Improvements in pens and pen-holders.

2380. Angclo J. Sedley, Regent Street—Improvements in constructing bridges and viaducts.

2381. George J. Gladstone, Blackwall—Improvements in apparatus for disengaging boats.

2382. Thomas Davey, Camborne, Cornwall—Improvements in the manufacture of safety fuses, parts of which are applicable to the manufacture of pipes and tubes of lead and other soft metal, gutta percha, caoutchouc, bitumen, and earthenware.

2383. Charles Watt, Graham Street, Walworth, Surrey, John Watt, Lorrimore Street, Walworth, and Thomas S. Haviside, Cornhill—An improved mode or method of bleaching palm oil.

2384. James Fawcett, Wakefield, Yorkshire—An improved material particularly adapted for the scouring, cleansing, and fulling of woollen or other cloths.

2385. James Cottrill, Studley, Warwickshire—An improvement or improvements in the manufacture of certain descriptions of needles.

2386. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in the process of preserving provisions, and in the apparatus employed therein.—(Communication from Alexander Lecomte, Montmartre, Paris.)

25th September, 1861.

2387. James Banks, Salisbury Street, Adelphi—Improvements in electro-magnetic telegraph printing apparatus or marking instruments, and the instruments or apparatus to be used in connection therewith.

2388. Carl G. Lenk, Maddox Street, Regent Street—An improved tank pen.

2389. Joseph Musgrave, Bolton-le-Moors, Lancashire—Certain improvements in the application of steam power.

2390. Thomas Bright and Robert Mills, Rochdale, Lancashire—Improvements in apparatus or means employed in the printing of yarns for carpets and other fabrics.

2391. Henry Purnell, Glasgow, Lanarkshire—Improvements in constructing and arranging warming apparatus.

2392. Richard A. Brooman, Fleet Street—Improvements in apparatuses for letting off water from and for admitting oil or other lubricating matter into steam cylinders.—(Communication from Isidore Duballe, Paris.)

2393. William T. Crane and Thomas J. Ellis, Liverpool Road—Improved means of applying breaks to omnibuses and other four-wheeled carriages.

2394. Thomas Richardson, Newcastle-upon-Tyne, and Robert Irvine, Hurlet, Renfrewshire—Improvements in treating gelatine.

2395. Alfred V. Newton, Chancery Lane—Improvements in the construction of and mode of working telegraphic apparatus.—(Communication from Giovanni Caselli, Florence, Italy.)

2396. Thomas Richardson, Newcastle-upon-Tyne—Improvements in the manufacture of muriate of iron for the purification of coal gas.

2397. John Vaughan, Middlesbrough, Yorkshire—Improvements in treating gas produced by blast furnaces in its passage from the blast furnaces to other furnaces, stoves, boilers, or other heating apparatus where gas may be employed.

2398. Godfrey Russell, Swan Hill, Shrewsbury, Salop—Spring stretchers or bedsteads for camp, hospital, or general use.

26th September, 1861.

2399. Daniel J. Fleetwood, George Street, Saint Paul's, Birmingham, Warwickshire—An improvement or improvements in nails.

2400. Thomas Bentley, Margate, Kent—Improvements in apparatus for beating eggs, and for mixing or agitating other fluids, compounds, or matters.

2401. Henry Nunn, Chelsea—Improvements in mangles.

2402. James Openshaw, William Entwistle and James Lord, Bury, Lancashire—Certain improvements in "mules" for spinning cotton and other fibrous substances.

2403. George Caldwell, Kilmaruock, Ayrshire, and John Y. Miller, Milliken Mills, Renfrewshire—Improvements in apparatus for dressing flour.

2404. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in smoothing irons.—(Communication from Charles J. B. E. Cailloue, Paris.)

2405. Samuel S. Robson, Sunderland, Durham—Improvements in machinery or apparatus for raising or lowering heavy bodies.

2406. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in knapsacks.—(Communication from Charles Sweney, Charlestown, Massachusetts, U.S.)

2407. Joseph Tessier, Rue St. Nicolas d'Antin, Paris—New means of saccharifying corns and cereal grasses.

2408. Marie F. A. Courtoise, Paris—Improvements in kilns or ovens for burning or calcining limestone, chalk, cement, and other substances requiring such process.

2409. Jacques D. D. Passager, Paris—Improvements in lamps for burning palm or other similar fat oil.

2410. Victor S. Lété, Paris—Improvements in aerated or sparkling white wines.

2411. Robert Davis, Splidts Terrace, Back Church Lane—Improvements in churns.

2412. William Clark, Chancery Lane—Improvements in the manufacture of peat.—(Communication from Auguste M. M. Comte do Lara et du Ren, Boulevart St. Martin, Paris.)

27th September, 1861.

2413. Richard Franklin and George Bacchus, Chapel Street, Stratford, Essex—A reversible back supporting nursing belt.

2414. Francis W. Shields, Parliament Street, Westminster—An improved method of applying wrought iron or steel plates to the covering and protection from the effects of shot and shell of forts, buildings, floating vessels, and other constructions.

2415. George Smith, Liverpool, Lancashire—Improvements applicable to gas meters.

2416. James Kimberley, Birmingham, Warwickshire—A new or improved machine for mortising, tenoning, sawing, boring, drilling, and grooving wood.

2417. Duncan M'Callum, Greenock, Renfrewshire—Improved arrangements for filling and closing bottles and other vessels.

2418. Samuel Rowsell, Buckland St. Mary, Somersetshire—Improvements in horse rakes.

2419. Joseph Waller, Annerly, Surrey—An improved smoke-consuming stove.

2420. Joseph S. Philips, College Crescent, Finchley Road—Enabling mankind to fly through the air.

2421. Georges J. Gauier and Emile E. Collet, Place de la Bourse, Paris—Improvements in envelopes.

28th September, 1861.

2422. John A. Knight, Symond's Inn, Chancery Lane—An improvement in steam pumping engines.—(Communication from Wellington Lee, East 19th Street, New York, U.S.)

2423. William N. Wilson, High Holborn—Improvements in sewing machines and apparatus connected therewith.

2424. Samuel W. Rix, Beccles, Suffolk—New and improved methods of attaching or fixing woodwork, ironwork, fittings, or furniture to walls or buildings, (and to which invention is given the style or title of "Ackrill and Company's patent fixing bricks with wood keys.")—(Communication from John Ackrill, Charles Maplestone and Prederic Kaweraw, Melbourne, Bourke, Victoria.

2425. John Reeves—Improvements in electro-magnetic engines for obtaining and applying motive power.

2426. Denny Lane, Cork—Improvements in apparatus whereby to regulate the passage of flow of gas, water, and other fluids.

2427. Joseph Moiroux, Rue St. Elizabeth, Lyon, France—A portable spring bedstead and mattress moveable and fixed, a hammock bed and spring mattress moveable and fixed.

2428. Thomas Potts, Old Kent Road, Surrey—An improvement in clasps for books, portfolios, desks, and other similar articles.

2429. Meinrad Theiler, Einsiedeln, Switzerland—Improvements in telegraphs.

2430. Charles Comer, jr., Salford, Lancashire—Improvements in the manufacture of metal tubes for bedsteads and other purposes, and in the machinery employed therein.

30th September, 1861.

2431. Thomas Smith, Aberdeen Street, Sheffield—A military steel umbrella.

2432. Edward Funnell, East Street, Brighton, Sussex—A self-acting alarum which can be fixed on tenders, guards' compartments, or other parts of railway trains for preventing collisions.

2433. John S. Bickford and George Smith, Tucking Mill, Camborne, Cornwall—Improvements in the manufacture of safety fuzes.

2434. Benjamin G. George, Hatton Garden—Improvements in the mounting of tablets, show bills, prints, photographs, and drawings, and of producing embossed ornamentation applicable to various purposes.

2435. Joseph Lush, St. George's Square, Portsea, Hants—Improvements in mashing attemperators.

2436. Charles H. Pennycook, Glasgow, Lanarkshire—Improvements in chimney hoods and ventilators.

2437. Wyvill J. Christy, St. Albans, Hertfordshire—An improved method of mail-ships of war.

2438. Etienne Reoche, Rue d'Enghien, Paris—Medicinal preparations applicable as a lotion and for internal application.

2439. Henry Hickman, Birmingham, Warwickshire—An improvement or improvements in protecting the locks and sights of fire-arms.

2440. Frederick Walton and Richard Beard, jr., Chiswick—Improvements in the manufacture of varnishes applicable to the waterproofing and coating of fabrics and other uses.

2441. Pierre A. F. Bobœuf, Paris—The preparation and application of certain new hemostatic and antiseptic agents.

1st October, 1861.

2442. William E. Matthews, St Helens, Isle of Wight—Conveying a line or other medium of communication from a ship or vessel for the purpose of obtaining relief or assistance in case of shipwreck or for any other purpose to which the invention may apply.

2443. John A. Knight, Symonds Inn, Chancery Lane—Improvements in the manufacture of boots and shoes.—(Communication from Henry Port, New York.)

2444. Oscar O. Lesourd, Panton Street—Improvements in joining pipes and tubes or in forming or securing the joints thereof.—(Communication from Jules Lemoine, Ruo Saint Paul, Paris.)

2445. Robert Nightingale, Maldon, Essex—Improvements in markers butts or mantelets.

2446. John W. Scott, Worcester—An improvement in gun wads.

2447. John W. Scott, Worcester—Improvements in tools for the manufacture of leather, and other rings, washers, and laces.

2448. William H. Payn, Dover, Kent—Improvements in apparatus for preventing the loss of, and facilitating the recovery of, ships' moorings and submerged property in general.—(Communication from Elton Templemore, Madras, India.)

2449. William S. Hogg, Rotherhithe, Surrey—Improvements in rendering columns, girders, doors, shutters, and other parts of buildings fire-proof.

2nd October, 1861.

2450. James Hesford, Bolton-le-Moors, Lancashire—Certain improvements in steam engines, and in valves for steam and other fluids.

2451. Albert D. Bishop, King Street, Cheapside—Improvements in pumps.

2452. Denis Rérolle, South Street, Finsbury—An improved steam digging machine.

2453. Andrew Wyley, Allsops Place, Regent's Park—Improvements in fire-arms.

2454. Alfred Fowler, Scott's Yard, Cannon Street—Improvements in buffers of railway carriages.

2455. James Davis and Thomas Evans, Ulverston, Lancashire—Improvements in the construction of engines to be worked by steam, air, or gases.

2456. William Maltby, De Crespigny Park, Camberwell, Surrey—Improvements in the manufacture of starch and starch gum.

2457. John A. Coffey, Providence Row, Finsbury—Improvements in motive power engines.

2458. Richard A. Brooman, Fleet Street—Improvements in the manufacture of figured coloured fabrics, and in machinery employed therein.—(Communication from Edme G. Bossuat, Paris.)

2459. Walkden Thompson and Thomas Stather, Kingston-upon-Hull—Improvements in hydraulic presses.

2460. Edgar Breffit, King William Street—Improvements in machinery employed in cutting hollow and solid corks.

2461. Edgar Breffit, King William Street—Improvements in the manufacture of boxes or cases, and in machinery employed therein.

2462. Charles G. Hill, Commerce Square, High Pavement, Nottinghamshire—Improvements in machinery, or in apparatus connected therewith, in the manufacture of bonnet and cap fronts, rouches, and millinery or other trimmings.

3rd October, 1861.

2463. John C. Dickinson, Blackburn, Lancashire—Certain improvements in steam engines.

2464. William T. Henley, St. John's Street Road, Clerkenwell—Improvements in magnetic and electric telegraph apparatus, which are also applicable to other purposes.

2465. John C. Hadden, Bessborough Gardens, Pimlico, and Carlo Minasi, Saint James's Terrace, Kentish Town Road—Improvements in the mode of discharging cannon, and in apparatus for facilitating the proper aiming with fire-arms.

2466. Thomas Warwick, Birmingham, Warwickshire—An improvement in the manufacture of umbrellas and parasols, and improvements in machinery to be used in the manufacture of umbrellas and parasols.—(Communication from C. A. Van Kirk, Philadelphia, U.S.)

2467. Henry Law, Rio de Janeiro, Brazils—Improvements in machinery and apparatus for raising ships and other vessels out of the water for the purposes of examination, cleaning, or repair, some of which are applicable to the docking of vessels for the same purposes.

2468. James A. Tannahill, Truro, Cornwall—An apparatus for counting money.

2469. Robert J. Ellershaw, Leeds, Yorkshire—An improved machine for expressing oil.

2470. Thomas Evans, Westmoreland Street, Westminster—Improvements in the manufacture of boots, shoes, and other coverings for the feet, and in the machinery, apparatus, and means connected with such manufacture.

2471. Camille Mauvernay, Lyons, France—An improved method of signalling the passage of trains upon railways.

2472. Joseph Wood, Birmingham, Warwickshire—Improvements in the manufacture of metal pens and holders, in tools employed therein, and in cards for carrying the same.

2473. William Malam, Skinner Street—Improvements in gas holders, and in apparatus for testing gas meters, also in apparatus for the manufacture of gas.

4th October, 1861.

2474. James Steuart, Vulcan Place, Castor Street, Poplar—Improvements in the treatment of oils obtained by the distillation of bones and other animal matters for the purposes of obtaining matters which may be used as pigments and dye stuffs.

2475. Peter Knowles, Bolton-le-Moors, Lancashire—Improvements in machinery for opening and cleaning cotton and other fibrous materials.

2476. Edward T. Hughes, Chancery Lane—Improvements in the permanent way of railways.—(Communication from Laurent Rigolier, Lyons, France.)

2477. Charles Hnsson, Nantes, France—Improved process for silvering looking glass in piles of several sheets superposed without interruption, which process consists in the use of a chemical powder.

2478. Adolphe David, jr., Nantua, France—Improvements in preparing and fixing street and other inscriptions or lettering.

2479. John Beesley, Coventry—Improvements in covering crinoline wire and other like substances.

2480. George Knox, Skinner's Place—An improvement in paper-making machines.

2481. Charles M. Elstob, Spalding, Lincoln—Improvements in buckets and portable water-cisterns.

2482. Thomas G. Ghislin, Hatton Garden—Improvements in the treatment or preparation of certain foreign plants or vegetable substances, and of the application of the same to various useful purposes, for which horn, shell, whalebone, indurated leather, fish skin, ivory, bone, hard wood, and compounds of india rubber or gutta percha, have hitherto been employed.

2483. John Pratt, Coventry, Warwickshire—Improvements in shuttles for weaving ribbons.

2484. James Dellagana, Shoe Lane—Improvements in finishing and perfecting curved or circular stereotype plates, and in apparatus for the same.

2485. Samuel Icely, Kent Cottage, Byron Street, Bromley—An improved manufacture of gongs.

2486. Joseph Tweedale, Milkstone, Rochdale, Lancashire—Improvements in machinery for preparing and spinning cotton and other fibrous substances.

5th October, 1861.

2487. John Lansley, Brown-Candover, Hants—Improvements in the construction of ploughs, drills, scarifiers, and such like agricultural implements, the said improvements relating to the mode of guiding or steering the same.

2488. John Edwards, Aldermanbury—Improvements in the manufacture of buttons.

2489. Ebenezer Partridge, Smethwick, Staffordshire—Improvements in hardening iron and steel, and composition or substance to be employed therein.

2490. William Rowan, Belfast, Antrim—Improvements in cylinders or drums and beaters for machines for scutching and preparing flax and other fibre.

2491. Patrick O'Connor, Wavertree, near Liverpool, Lancashire—Improvements in the construction of gas stoves for heating and warming.

2492. John S. Collins, Liverpool, Lancashire—Improvements in reefing and furling the sails of ships and other vessels.

2493. James Turner, Upper Thames Street—An improved machine for mixing, mincing, and pounding.

2494. George Nares, Portsmouth, Hants—Improvements in apparatus for effecting communication between places otherwise inaccessible to each other.

2495. William Clark, Chancery Lane—An improved gas regulator and purifier denominated the "French purifier."—(Communication from Messrs Francois Rochebrnn, Jean B. F. Maliqnet-Allegret, and Lncien V. Teste, Boulevart St. Martin, Paris.)

2496. Thomas Hnghes, Birmingham, Warwickshire—An improved high pressure tap for regulating and controlling the flow of steam, water, or other fluids, which tap I purpose designating as "Hughes's equilibrium pressure tap."

2497. William Squire, Upper Montague Street, Bryanstone Square—Improved machinery for planing and shaping wood.

7th October, 1861.

2498. Bernard P. Walker, Wolverhampton, Staffordshire—Improvements in rifle sights and rifle sight guards, and a new or improved rifle cleaner.

2499. Alexander Chaplin, Sackville Street—Improved combined winding engine boiler and cooking and distilling apparatus, including improvements also applicable separately.

2500. William Callcott, Park Village, East—Improved means and apparatus for producing scenic effects.

2501. Wedderspoon Keiller, Perthshire—Improvements in signalling for rifle practice.

2502. George K. Stothert, Bristol—Improvements in condensing apparatus.

2503. James E. J. Sansnm, Lower Kennington Lane, Surrey—Improved machinery for mashing malt.

2504. Frederick J. Evans, Horseferry Road, Westminster—Improved apparatus for generating gas.

2505. John C. Willsher, Petches, Finchingfield, Essex—Improvements in the construction of combined thrashing and dressing machines.

8th October, 1861.

2506. Alfred Ford, Priory, Battersea, Surrey—An improved method of waterproofing.

2507. William Catford, Chard, Somersetshire, and John S. Wheatley, Nottinghamshire—Improvements in the manufacture of bobbin net or twist lace.

2508. Henry Willis, Albany Street, Regent's Park—Improvements in the construction of organs.

2509. George Glover, Lowestoft—Improvements in constructing fire proof doors and window shutters.

2510. William Simpson, Calais, France—Improvements in the manufacture of twist lace made in twist lace machines.

2511. Samuel Bremner, Ludgate Hill—Improvements in the construction of printing machines, and in driving or actuating the same.

2512. Isaac Evans, jr., Cefn Mawr, Ruabon, Denbighshire, North Wales—An improved miners' lamp.

2513. John E. Grisdale, Cheapside—Improvements in certain tickets or passes for railway and other purposes.

9th October, 1861.

2514. Robert W. Sievier, Gnildford Street, Russell Square—Improvements in batteries for the purposes of war.

2515. Isham Baggs, Green Terrace, and James T. Parkes, Almorah Terrace—Certain improvements in the manufacture and treatment of india rubber and vulcanite as applied to various purposes.

2516. William Smith, King Street, West Smithfield—Improvements in apparatus for measuring and regulating the pressure of gas.

2517. Edward Haslewood, Lothbury—Improvements in apparatus for preventing or lessening the slip of the driving wheels of locomotive engines.—(Communication from Samuel T. Armstrong and Jared W. Post, Broadway, New York, U.S.)

2518. James Walker, Knockagh Carrickfergus, Antrim, Ireland—An improved chimney top, cap, or cowl for the prevention of the descent of sooty exhalations, curing of smoky chimneys, and ventilation of apartments.

2519. John Norman, Glasgow, Lanarkshire—Improvements in hammers to be worked by steam or other elastic fluid, and in anvils for the same.

2520. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in machinery for manufacturing shoes for horses and other animals.—(Communication from Thomas R. Taylor, Cleveland, Ohio, U.S.)

2521. Henry B. Coathupe, Saint James's, and Frank H. Waltham, Palace Street, Haverstock Hill—Improvements in obtaining or producing and applying embossed or raised and engraved or indented metal or other surfaces.

2522. Frederick Curtis, Massachusetts, U.S.—A new and useful improvement in fire-arms.

2523. William Palmer, Sutton Street, Clerkenwell—Improvements in lamps and lamp wicks.

2524. John J. Russell, Wednesbury—Improvements in hand stocks and dies for cutting screws.

2525. Thomas Tidmarsh, Dorking, Surrey—An improved artificial manure.

2526. John Schwartz, Osborn Street, Whitechapel—An improvement in the manufacture of sugar.

10th October, 1861.

2527. William J. Williams, Warnford Court—An improved process of charging illuminating gas with the vapour of the hydruret of carbon, for the purpose of increasing its illuminating properties.

2528. Thomas P. Bennett and James Collier, Gilnow Mills, near Bolton-le-Moors, Lancashire—Certain improvements in or applicable to self-acting mules for spinning.

2529. David S. Brown, Eton Lodge, Ashby Road, Islington—Certain improvements in propelling and sustaining balloons and aerial machines in the air.

2530. William Mould and John Hall, Belmont, near Bolton, and Samuel Cook and William H. Hacking, Bury, Lancashire—Improvements in machinery for manufacturing healds or harness used in looms for weaving.

2531. Charles W. Felt, Massachusetts, U.S.—An improved machine for setting, spacing, justifying, and distributing printer's type.

2532. James Stevens, Birmingham, Warwickshire—Certain improvements in connectors and adjusters for connecting and adjusting crinolines.

2533. Louis Christoph, Paris, William Hawksworth, Linlithgow, and Gustavus P. Harding, Paris—Improvements in the manufacture of cast steel and other metal tubes, and in the machinery or apparatus employed therein, parts of which improvements are applicable to the manufacture of gun barrels and ordnance, and to the rifling of same.

2534. Benjamin Browne, King William Street—A new improved spring.—(Communication from Perry G. Gardiner, New York, U.S.)

2535. James Downs, Kingston-upon-Hull, Yorkshire—Improvements in pumps and stops used for working hydraulic presses.

2536. William E. Newton, Chancery Lane—Improvements in heating the feed water of steam engines.—(Communication from Francis B. Stevens, Weehawken, New Jersey, U.S.)

2537. William Payne and John Burgum, Birmingham, Warwickshire—Improved packing for engines and machinery.

2538. William Clark, Chancery Lane—Improvements in apparatus for bending iron rails or bars.—(Communication from Henri N. Roge, Boulevart St. Martin, Paris.)

2539. Abraham English, Hatfield, Herts—Reins or apparatus for preventing harness horses falling.

11th October, 1861.

2540. Charles N. Kernot, West Cowes, Isle of Wight, Southamptonshire, and Martin D. Rucker, Fenchurch Street—Improvements in the method of obtaining ammoniacal salts and other valuable products from liquors or substances containing ammonia, and for utilizing the residuum.

2541. Robert Richardson, Great George Street, Westminster—Improvements in the manufacture of railway fastenings, and a mode of preparing rails and fish plates to receive them.

2542. Thomas B. Collingwood and Abraham Butterworth, Rochdale, Lancashire—Improvements in throstle and doubling frames for spinning and doubling fibrous materials.

2543. William E. Newton, Chancery Lane—Improvements in the condensers and condensing apparatus of steam engines.—(Communication from Francis B. Stevens, Weehawken, New Jersey, U.S.)

2544. Numa Stram, Ashby Street, Northampton Square—Improvements in watches.

12th October, 1861.

2545. John Clark, Glasgow, Lanarkshire—Improvements in electric telegraph apparatus, and in means for submerging and raising electric telegraph sea cables.

2546. Edgar Corke, Southborough, Tunbridge Wells, Kent—An improved instrument to be attached to the bayonet or barrel of a rifle or other fire-arm for estimating distances.

2547. Robert Edge, Dean Mills, near Bolton-le-Moors, Lancashire—Certain improvements in machinery for preparing, spinning, and doubling cotton and other fibrous materials.

2548. Samuel R. Carrington, Stockport, Cheshire—Improvements in hats and caps.

2549. John C. Ramsden, Bradford, Yorkshire—Improvements in healds or headles for weaving, and in the machinery or apparatus for making the same.

2550. Victor Pirson and Augustus Deyeyser, Brussels, Belgium—The application of a new material in the manufacture of paper cardboard and yarns.

2551. Edward T. Hughes, Chancery Lane—An improved compound to prevent the incrustation and sediments of calcareous matters in boilers.—(Communication from Ernest L. Pichio, Paris.)

2552. Henry Nelson, Manchester, Lancashire—Improvements in machinery or apparatus for punching washers of throstles and other similar purposes.

2553. Robert C. Furley, Edinburgh, Mid-Lothian—Rendering pills tasteless.

2554. Matthew Cartwright, Carlisle, Cumberland—Improvements in stench traps.

2555. Alfred V. Newton, Chancery Lane—Improved machinery for dressing or cleaning wheat and other grain.—(Communication from Samuel Bentz, Hood's Mills, near Baltimore, Maryland, U.S.)

2556. George Twigg, Birmingham, Warwickshire—Improvements in clasps or fastenings for stay busks.

14th October, 1861.

2557. Edouard R. M. V. de la Jousselandière, Nantes, France—A machine for the weaving of cords and ropes.

2558. William Macnab, Greenock, Renfrewshire—Improvements in marine steam engines and boilers.

2559. Henry J. Distin, Great Newport Street, Leicester Square—Improvements in metal musical wind instruments.

2560. John Browning, Minories—Improvements in barometers.

2561. Benjamin Taylor and Charles Edkins, Birmingham, Warwickshire—Improvements in porterobes or dress suspenders, and also in apparatus for the suspension of curtains, draperies and other articles.

2562. Frederick B. Houghton, Clarendon Terrace, Kensington—Improvements in apparatus employed in reducing straw and other vegetable substances in the manufacture of pulp for making paper.

2563. Mowbray Walker, St. Benet's Place, Gracechurch Street—Improvements in breech-loading rifles.

15th October, 1861.

2564. John Flinn, sen., Coventry—Improvement in watches.

2565. Corneille Wynants, Saint Josse-ten-Noode, Belgium—An improved chase for printing presses.

2566. William Bland, Leeds, Yorkshire—Improvements in pickers used in looms for weaving.

2567. William Ross, Glasgow, Lanarkshire—Improvements in constructing taps or valves.

2568. John Gilbert, Old Kent Road, Kent—Improvements in endless railways.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from July 19, to September 25, 1861.

July, 19,	4387	William Whitley, 6 Queen's Road, Bayswater, W., "Washing Machine."
" 22,	4388	Giden Blake, 6 St George's Terrace, Trowbridge, Wiltshire.—"Valve for Gas Furnaces."
" 27,	4389	James Barry, Newton Abbot, Devon.—"A Combined Food Preparer."
Aug. 1,	4390	Charles W. Heckethon, 8 St Ann's Road, Brixton, S.—"A Combined Spitoon and Footstool."
" 1,	4391	William H. Blanch, Liverpool.—"The Blanch Combined Muzzle Stopper Oil Bottle, Nipple Pricker, and Rifle groove Protector."
" 5,	4392	Joseph Hardwick, 429 High Street, Cheltenham.—"The Ventilated College Cap."
" 7,	4393	George Hazeldine, 5 Lant Street, Borough, S.—"Lynch-pin, specially adapted for Gun Carriages."
" 7.	4394	William Harrison Barwell, Northampton.—"Portable Music and Reading Stand."
" 7,	4395	James Kerr, Henry Street, Bermondsey, S.—"Combined Rifle Muzzle Stopper and Sight Protector."
" 12,	4396	William White Rouch, 180 Strand, W.C.—"Portable Photographic Operating Chamber."
" 13,	4397	Day and Millward, Birmingham.—"Weighing Machine."
" 14,	4398	Faviell and Burrell, Leeds.—"A Malt Shovel."
" 14,	4399	George Speight, 5 St John's Street Road, Clerkenwell.—"A Page and Dress holder."
" 16,	4400	Griffith and Browett, Birmingham.—"A Glue Pot."
" 22,	4401	Drury, Bros. and Walker, Don Iron Works, Sheffield.—"Lock Spanner."
" 24,	4402	James Nason, Stratford-on-Avon.—"Agricultural Drill."
" 26,	4403	William H. Blanch, Liverpool.—"The Blanch Combined Rifle Sight Protector, Object Tube, Nipple Key, and Turn Screw."
" 26,	4404	Isaac Marshall, Nottingham.—"An Improved Stamp Guide Bar."
" 28,	4405	Isaac W. Petty, Manchester.—"A Register Holder for Rifle Practice and other purposes."
Sept. 7,	4406	C. A. Orth and Sons, 15 Chiswell Street, E.C.—"The Imperial Toilet and Travelling Bag."
" 10.	4407	Parkins and Gotto, 24 and 25 Oxford Street, W.—"Dispatch Box."
" 20,	4408	T. G. Forneaux, Coventry.—"Watch Cap and Fastener."
" 25,	4409	Goodhall and Dimsdale, 9 Pancras Lane, City, E.C.—"A Copying-press Water Well."

EMBRASURES AND GUN-MOUNTING.

In the gallant old times of our fathers and grandsires, when 32-pounders were the heaviest guns commonly mounted in shore batteries or fortified places, and when the smooth-bored musket, or the scarcely more accurate "belted ball" rifle, were the "arms of precision," the shape and size of embrasures did not greatly trouble the minds of Royal Engineers or Artillerists. Experience had shown that the per centage of shot which in the best hands, and even from land batteries, entered the wide open jaws of the old wall-sided embrasures was very small, and if directed from guns afloat, so small as to be scarce regarded; while the safety of the gunners, though showing themselves freely enough through the embrasure, or above the parapet, was, except at very short distances, pretty secure against the small arms in vogue. The chief apprehension of the old artillerist was of the deadly shower of splinters sent in through the embrasure, from the shattered stone of its cheeks, when these chanced to be struck, and against this casualty a variety of expedients were devised (lining with facines, &c.,) as may be found in the old text books.

Abroad, however, after the conclusion of "the wars of the giants" at Waterloo, occasional or individual efforts were made to improve the construction of embrasures by narrowing the opening in various ways, all more or less involving some alteration in the modes of mounting the guns within. Of these, the most successful attempt appears to have been that known as the Montalambert, or inverted embrasure, the essential improvement of which consisted in bringing forward the pivot of the "traverse" or "racer" (on which the gun carriage was mounted, and round which it moved horizontally), to a point within the thickness of the parapet or front of the casemate, and making the splay of the embrasure sufficient for working the gun, all in rear of this point. This method admitted of *narrowing* considerably the minimum width between the jaws or cheeks of the embrasure —still giving the same angular range of horizontal traverse in pointing the gun—but it was incapable of altering or improving in any way the *height* of open aperture necessary to enable the gun to be elevated and depressed. It was, moreover, liable to a still more serious objection; the embrasure became reduced, as respected its sides, to two mere wedges of stone-work, with their edges pointing towards each other, two of their sides forming the face of the rampart, and the other two splaying away from each other at the "cheeks." So little material then remained at the sides of the embrasure that a heavy shot striking anywhere near about it in front, broke off and drove in a large mass of stone at once.

The plan was hence only carried into effect to a very limited extent, and settled down very generally into forming embrasures with cheeks splayed both towards the front and towards the rear—the depth of the latter square to the face in proportion to that of the former—varying from 2 : 1, to 4 : 1.

The late Colonel Colquhoun, R.A., attempted to push Montalambert's principle to its limit, and produced designs for embrasures, in which, by placing practically all the splay inside, he reduced the *width* of the opening to not much more than the greatest diameter of the gun, but, in doing so, appears to have forgotten altogether this attenuation of the stone work at the sides. He thus produced an embrasure that, it is believed, all military engineers held to be impracticable, and which of course left the height of opening as before. About seven years ago, attempts were made at Woolwich to reduce the aperture to its narrowest limits consistent with freely pointing guns of ordinary mounting, and at the same time to render the cheeks less vulnerable and dangerous when struck, by forming the whole embrasure of a single casting in iron. Neither object was attained, and, up to the close of the Crimean war, nothing had been attained beyond narrowing the cheeks more or less, and the proposal to apply iron or other shutters, proof against rifled small arms, and capable of being rapidly and readily closed and opened again between the rounds. The importance of something of this sort had been demonstrated by the success of the admirably devised rope mantlets with which the Russians protected their gunners at Sebastopol.

The immense and rapid expansion of the rifle principle, and its application both to small arms and to artillery, since that period, have compelled attention to this detail of fortification, and, if we mistake not, the communications and designs which we publish this month from Mr Robert Mallet, present the first decisive attempt to deal with the difficulty of the subject fundamentally. Mr Mallet's designs may be, and probably are, open to various objections, of more or less weight, as to detail, and to choice of better or worse modes of carrying out his primary notion, but nothing short of his leading ideas appear capable of solving the problem. It is this, How shall we make an embrasure or a port in an armour-plated ship's side, so that it shall present no more aperture than will permit the passage freely through of the muzzle of the gun, and yet will admit of its being laid and pointed with full angular motion, and of the enemy or mark being clearly seen. For the present, we say nothing of subordinate but important details, that must also be provided for, such as no return of smoke, &c.

The difficulty heretofore stands thus:—Horizontally, the gun can be readily enough, and actually is usually pivotted, at a point nearly plumb beneath the muzzle, and so the horizontal dimension of the aperture may be contracted to the utmost; but the elevation and depression is performed round a horizontal axis (the trunnions) far in rear of this. The vertical dimension, therefore, must remain large enough to admit of the free movement of the forward part of the gun in its vertical arc.

To reduce the aperture to its smallest limit, *both vertically and horizontally*, it is obvious that the trunnions must be moved forward until they are plumb over the axis of horizontal traverse; that is to say, *the gun must move horizontally and vertically round one point in its axis*, close to or not far below, the muzzle; in other words, *it must swivel in all directions round its own muzzle*. The proposal to carry this out, is Mr Mallet's leading idea; and he attempts it, first, by a novel arrangement of mounting; secondly, by the adaptation of this mounting to an improved form of embrasure.

It appears that these designs were first laid by their author before General Sir John F. Burgoyne, G.C.B., Inspector General of Fortifications, in Dec., 1856, and remained in that distinguished officer's possession up to Oct., 1858. At the latter period Sir John Burgoyne, writing to Mr Mallet, "requested to know whether he had abandoned his idea of being able to mount cannon in such a manner as to *elevate and depress upon the muzzle as a fixed point*," adding "if that could be done *practically*, that is without impeding the accurate, easy, and simple service of the piece, and without great refinement, or extent of machinery, or want of simplicity in gun and carriage, it would afford a new element of security by reducing the vertical opening of the embrasure." The General thus, in his usual clear and forcible language, puts the problem and its results if solved.

In reply, Mr Mallet forwarded to Sir John Burgoyne some additional details, with written descriptions; and early in December, 1858, was informed by Sir John that he had sent forward his designs and descriptions to General Peel, then Minister of War, "with a memorandum stating how important he considered the principles to be, and with a recommendation that the project should be fairly and impartially considered upon its merits."

We have not yet learned from Mr Mallet what the issue of this "sending forward for report" has been, and in any case shall reserve to a succeeding number all remarks and criticism upon the communication.

Description of an Improved Construction of Embrasure, *and of a* New Traversing Slide and Gun Carriage *adapted thereto, applicable either to Casemates or to open Parapets, (or, with modifications, to Shipping,) by* Robert Mallet, C.E.*

The object in view is to so combine the construction of embrasures and gun carriage in batteries, (the principles being equally applicable to armed ships,) as to carry out to the utmost the important principle of General Sir John F. Burgoyne, viz.:—"To afford complete protection to those working the guns of coast batteries, against the transitory fire of shipping engaged in attack, by closing to the utmost practicable degree the aperture of the embrasure by wrought iron shot-proof surfaces."

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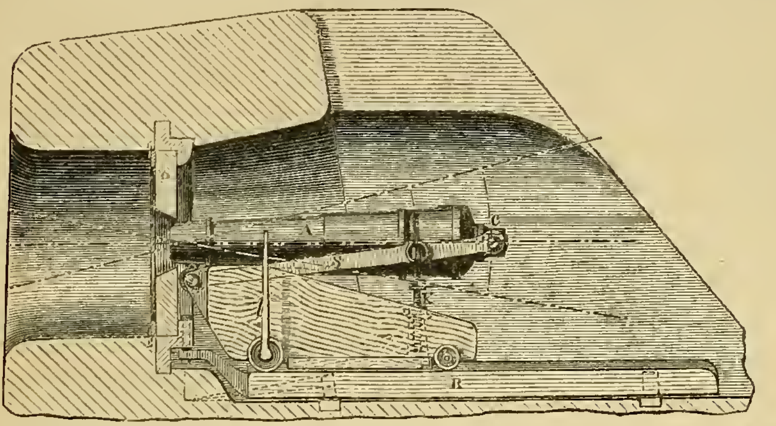
* Nothing of these designs or descriptions have ever previously been printed.

Hitherto it has been proposed to limit this closing up to such extent as should still admit of the use of cannon mounted in the ordinary way, upon the usual trunnions. The horizontal traverse being made round a point situated nearly vertically beneath the muzzle of the gun, which, when fired, was to be situated in advance of this centre. This mode of mounting the gun, and more especially the mode of elevating and depressing in common use, involve the necessity of an aperture through the throat of the embrasure much larger than the diameter of the muzzle of the gun, to admit of its motions in the vertical and horizontal planes.

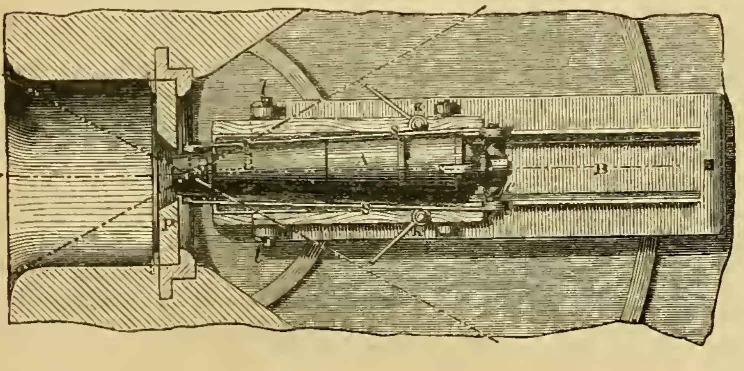
Fig. 1.



When the centre of horizontal movement (or slide pivot) is placed, as above, beneath the muzzle, much difficulty occurs in providing sufficient and convenient room at the sides of the ordinary slide and gun carriage, when the gun is trained to its most oblique angle with the face of the battery; and this most so in casemates.

The present designs propose to overcome these difficulties, by an entirely new form and construction of embrasure, and by the adaptation to it of a new traversing slide and new gun carriage, each possessing certain individual advantages capable of being adopted separately, but which, in combination, admit of the leading principle now proposed (as it is believed for the first time) being fully carried out. This leading principle is such a construction as enables the gun to be traversed and to be elevated or depressed round a point close to and beneath the muzzle, so that the gun swivels (practically) in all directions about its own muzzle. The muzzle therefore becoming, as respects the aperture of the embrasure, a fixed point, both vertically and horizontally, and thus the aperture itself reduced to one only a little more than equal to the diameter of the muzzle of the gun, which, when in position for firing, almost completely closes up the aperture.

Fig. 3.

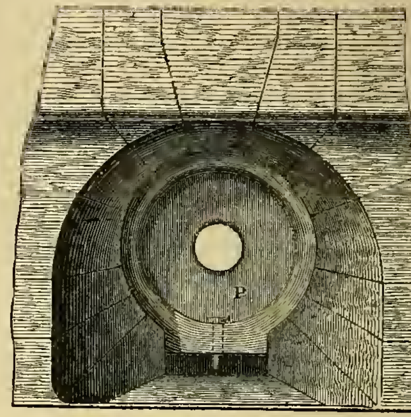


THE EMBRASURE (WHETHER FOR CASEMENTS OR FOR OPEN PARAPETS OF MASONRY).

It is proposed that the aperture of all embrasures should be circular, and the splay of the sides be as small as possible, so as to form the least possible *tunnel* for the entrance of the shot, and to afford the best form for a firm and coherent combination for the ring of masonry, set as arch stones or voussoirs all round, and giving the most convenient, strong, and economical form for the application of the iron plates, &c., which are to reduce the opening of the embrasure in the masonry down to that of the muzzle of the gun.

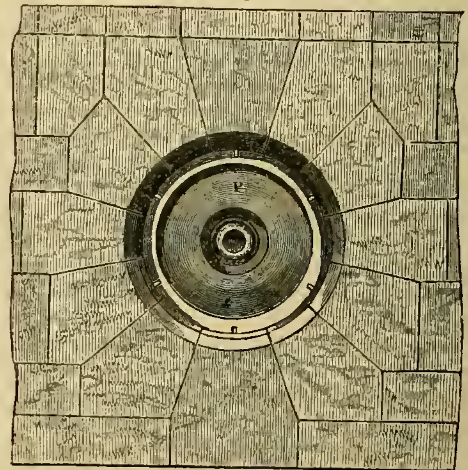
Assuming the wall of the defended face of the battery to be 10 feet in thickness, it is proposed to construct the conical sides of the circular embrasure, of a ring or arch of *thorough stones*, each 10 feet long, of granite, or of certain tough and hard Scotch whin stones, either of which, as well as many other more or less suitable building stones, can be readily had in blocks of this magnitude—the size of each single block, and effectual combination of each to all the others, giving the best security against the shattering and dislocating effects of the heavy shot that will in future be fired against land defences, occasionally, probably shot of not less than 300 lbs. weight.

Fig. 2.



Somewhat in advance of the mid thickness of the wall there is inserted a circular ring of cast or wrought-iron, forming a large deep rabbate in section. The exterior portion of which, round its entire circumference, is let into the surrounding ring stones of the embrasure, and either bedded into them with Portland or other cement, or run with lead. The inner portion or circumference of this ring, projecting inwards, and forming a seat into, and against which the circular wrought iron plate or plates, P, figs. 1, 2, 3, and 4, are fixed, which, save their own small central aperture, completely close up the embrasure.

Fig. 4.



The effect of this heavy ring, thus rabbated into the ring of arch stones all round the embrasure, is to unite and combine them all, in such a way, that when any one stone is singly struck by a heavy shot, the effects of the blow are distributed to all the others, and no single stone is dislodged or driven out.

The internal jambs of the embrasure arc, near the ground, splayed more than above, to admit of horizontal traverse, as seen in fig., 2, viewing the embrasure from inside the casement. When the embrasures are pierced in open parapets, it is proposed to form the latter, as shown in figs. 11, which are vertical and horizontal sections, and to place inside between each a sort of dwarf traverse of masonry, sloping like a buttress from the crest of the parapet to the ground, and to draw gradually into these the directions of the joints of the upper ring stones of the embrasures, so that blows delivered upon their exterior ends by shot, shall expend their effort finally against these buttresses, without dislodging, singly, any of the upper stones of the parapet, which, as being least weighted, are the most vulnerable. These traverses would, from their form, give greatly increased cover to the gunners, and give considerable protection against the dismounting of the guns by enfilade and "recochet" fire. In fact, this system of parapet would give to open batteries nearly all the cover, both from vertical and horizontal fire, due to closed casemates, and yet be free from the objections of smoke, &c., due to the latter.

The division walls between casemates should be constructed in the same way, and for like reasons, as the buttresses shown in figs. 11.

While the adoption of very large and heavy stones round the jambs of the embrasure, is recommended, it does not follow that the remainder of the work may not be formed of smaller material, and much of the interior, including the traverses, of hard brick, such as the Staffordshire blue brick—a material offering probably a great resistance to shot, and peculiarly fitted for the interior of casemates from the comparative absence of splinters when struck.

THE WROUGHT-IRON STOPPING PLATES.

These plates, P, fig. 1 and corresponding parts of the other figs., are mere circular flat discs with a central aperture for the muzzle, a form admitting of great facility of execution and economy of material, with equalization of strength.

The plate or disc, whether in one or in several thicknesses, is merely placed within the rabbate of the cast-iron curb ring already described, and abuts firmly against it with an interposed flange, either of wood, felt, or other such material, of an inch and half to an inch thick between them.

The disc is prevented from falling outwards or being driven outwards by its own elastic rebound after the stroke of a shot simply by a circular curb ring, made of two plies of elm, or other tough timber, placed in front of the disc, and secured in place by 6, or 8, or more wrought-iron, short cylindrical, and slightly taper plugs, each driven with a slight blow into a hole jumped in the surrounding arch of ring stones in a radical direction.

The advantages of this arrangement are, First—Great simplicity of connection between the iron and the stone work. Secondly—That the stroke of shot upon the iron, although bending or breaking *it*, has no tendency to dislocate the masonry by the bent or broken iron acting upon it. Thirdly—That a damaged or disabled disc can be readily dislodged and a new one put in its place without silencing the gun, except for a very brief interval. Fourthly—That there are no bolts, rivets, or any other loose parts capable of being driven by rebound or detachment into the interior of the battery, or forming "mitraille" when the disc is struck.

The writer has shewn in his work, "On the Physical Condition Involved in the Construction of Artillery," p. 123, that *all* wrought-iron, however tough and good, will break, *short and brittle*, under the stroke of a shot sufficiently heavy to damage its form, whenever the velocity of the shot exceeds 560 feet per second.

To derive the full defensive advantages from wrought-iron, therefore, and bring *its toughness* into play, the aim should be so to arrange preliminary obstacles to the movement of the shot, that its velocity, before it reaches the final resisting plate which is to stop it, shall be reduced below 560 feet per second.

It is proposed, in accordance with this view, as the most effectual mode of resisting shot by wrought-iron, to adopt some modification of the arrangement of plate shewn; and in place of a single iron plate to stop the circular aperture of the embrasure with several successive discs or plates of wrought-iron, from 1 to 2 inches thick, with plates of elm or other tough and hard timber alternating between them, and at the rear of all these the thick disc of wrought-iron or "stopping plate" which is finally to arrest the shot; the whole being secured in place in the same simple way as the single disc shewn in the several figures.

The loss of *vis viva* in any projectile by passing alternately through plates of widely different elasticity and hardness—such as those of wood and of iron—is very great, much greater than if the same total thickness of each were passed through in succession.

This method of closing the embrasure appears to have several particular advantages attendant on it, such as exposing the least costly front of the structure to the common chances of damage, and shielding from such the interior and most valuable thick disc of iron, facility of manufacture and repair, &c., and to have but one partial disadvantage, viz , that the increased total thickness involves a larger external spread of cone at the central aperture for the muzzle, and hence greater chance of shot entering it and striking the muzzle of the gun.

The preceding arrangement of compound resisting plates, though deemed the best, is not essential to the present designs, and hence a single thick disc is shewn in the figures.* The manufacture of circular discs of wrought iron, up to even eight feet diameter, and from four to even twelve inches thick, offers no difficulties; and were such in considerable demand, they could be afforded at a very moderate price.

Fig. 5.

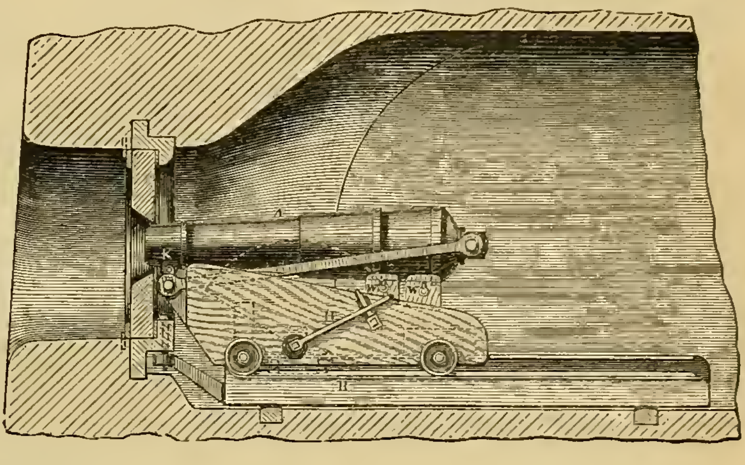


Fig. 6.

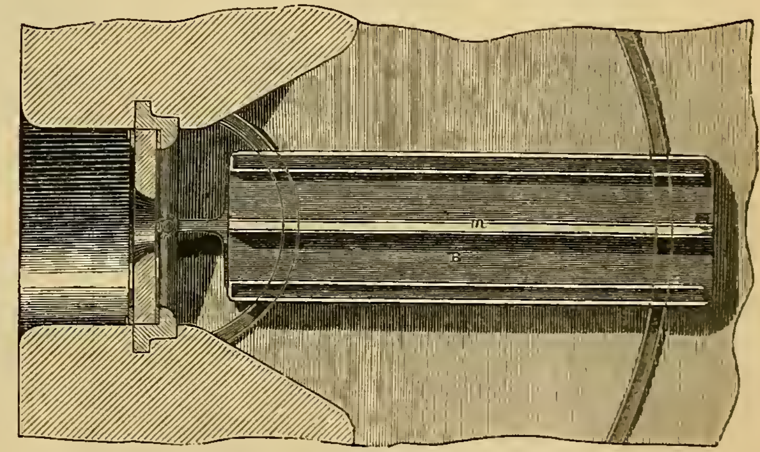
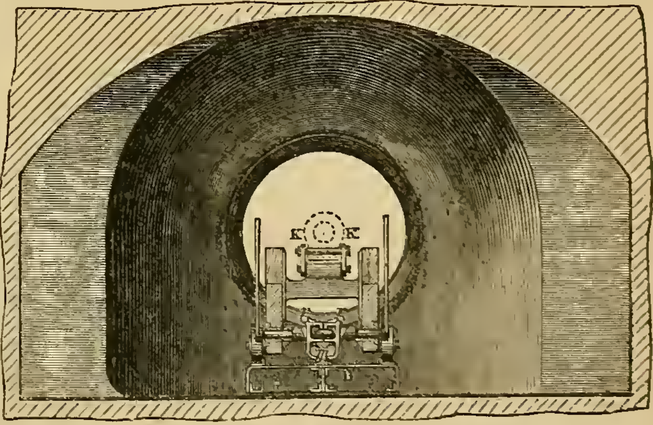


Fig. 7.



THE TRAVERSE SLIDE.

It is proposed to make the floor of the casemate, or open battery,

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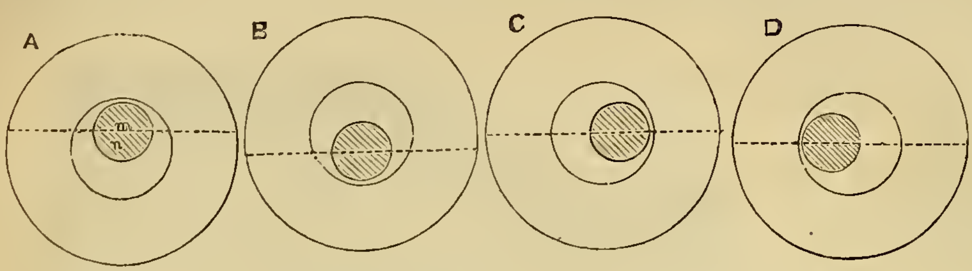
* A sheet of designs, not here published, and showing this arrangement of compound plates, was forwarded with the others to Sir John Burgoyne by the author.

quite level, of stone, and to sink into it, flush, or nearly so, two flat segmental rails of cast iron, their upper surfaces being horizontal, upon which the slide is to traverse.

The slide, B, in all the figures, consists of a nearly rectangular flat frame of boiler plate, something like the lid of a box, closed in on top (or open in panels occasionally) and at the sides and ends; it is, in fact a sort of broad and very shallow hollow box girder laid down flat, and admits of the four conical rollers, upon which the frame traverses, to be placed within it, and in its own depth, so that the total height from the floor to the top surface of the slide is not more than ten or eleven inches. The centre of traverse motion is a pivot bolt, conveniently made fast to the rabbate ring of the embrasure at its lower side, and the slide is made to traverse by the insertion of a handspike into a socket provided at the rear end. On the top side of this slide are secured two iron guide rails for the gun carriage to recoil upon, and jaws at the forward end to prevent the gun being run too far forward.

Fig. 8.

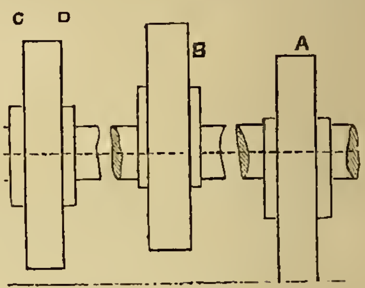


Original Position. Eccentric throw, = M N.

Roller is raised above the Plane, P R, by an interval = twice the throw of the Eccentric.

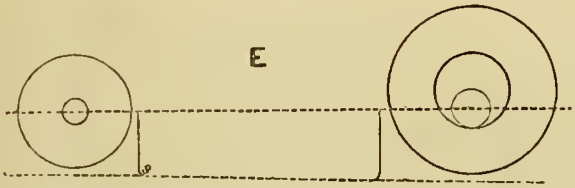
Roller raised above P R, by an interval = the throw, M N.

Fig. 9.

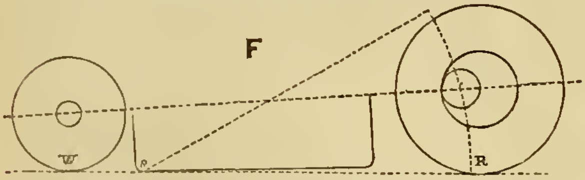


Sections on line of Shafts.

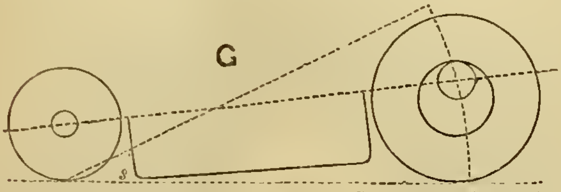
Fig. 10.



No. 1.—Gun Carriage wholly on the sledges or slides, and the Truck Wheels free of traversing slide, as when run forward and ready to fire.



No. 2.—Gun Carriage about being raised off the sledges. It now bears on the point, S, of the sledges, and upon the eccentric rollers, R, which are partly depressed; the after trucks, W, have just made contact with the surface of the traversing slide.



No. 3.—The eccentric rollers fully depressed, the Gun Carriage lifted wholly off the sledges, and ready to run forward upon the four truck wheels or rollers, R W.

The strength and lightness of this construction are very great; a slide for sixty-eight pounder gun would weigh under fifteen cwt., its cost would not exceed the common timber slide, which does not admit with the same facility the placing the rollers within the depth of the timbers, and from its lowness, and being quite flat on top, and the rounding of its sides and edges, it would be very little liable to damage from recochet or from shells, and would offer far less obstruction, and occupy less room in working the gun in casemate than the usual slide. The flat and unobstructed floor, and the level top to the slide, are submitted as decided advantages, as presenting no obstacles to trip up men in working at night or in the dark.

THE GUN CARRIAGE.

The gun carriage proposed may be formed either wholly of wrought-iron (as in sheet A, not here published,) or partly of timber as shown. Iron is preferred, and it is submitted that the conditions herein assumed, viz., that *the entrance of shot to disable the gun is guarded against so as practically to be impossible*, admits of the application of iron, which, when the gun or carriage is liable to be struck, is an unfit material. The gun carriage, whether wholly of wrought iron, or partly of timber, consists generally of two side checks connected together beneath the gun. The gun itself may be of the ordinary pattern, but without trunnions and without ring cascabel, but provided with a transverse horizontal eye just under the muzzle and with a cylindrical projection at the cascabel.

Fig. 11.

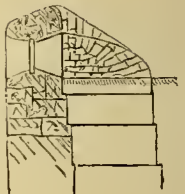
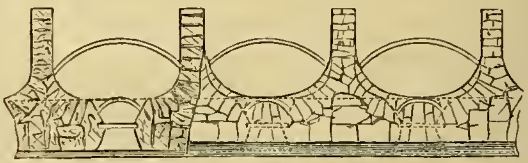


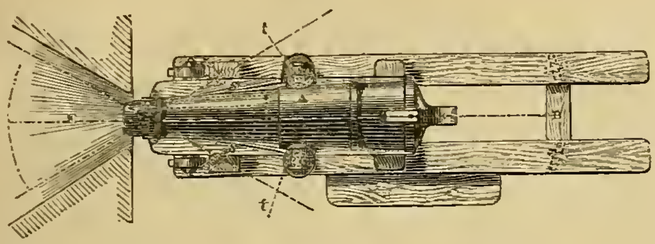
Fig. 11.



Vertical section through Embrasure, and elevation of traverse.

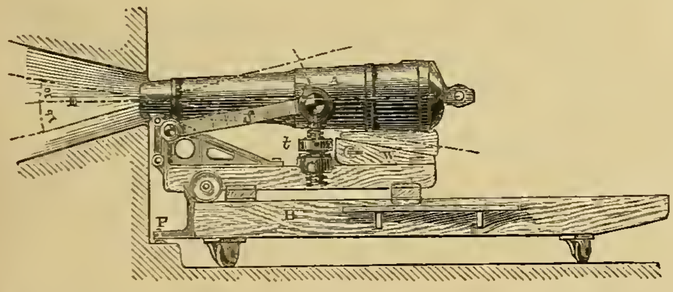
The muzzle of the gun rests upon a cross-bolt (by the intervention of two short vertical links, K K, fig. 7, free to vibrate at their upper ends through a small arc) fast to the carriage. The cylindrical cascabel passes through a wrought iron cross head, C, figs. 1 and 3, the outer ends of which are inserted into the rear eyes of two wrought-iron side links, S, figs. 1, 2, 12, 13, D, and L, fig. 5, the forward ends of which are connected with the cross bolt supporting the muzzle. When the gun is fired, the recoil acts through the breech and cross head, C, directly upon the two side links, S or L, and upon the large cross bolt beneath the muzzle in pulling the carriage backwards, but the small vibrating links prevent any strain upon the muzzle of the gun. A certain amount of elasticity is given to prevent any jarring between iron and iron by the introduction of a vulcanized india rubber flange between the breech of the gun and the cross head, as in figs. 1, 2, and 5, or the like may be applied at the advanced end of the side links. The rear part of the gun is supported, elevated, and depressed by means of two large threaded elevating screws, each $2\frac{1}{2}$ or $2\frac{3}{4}$ in diameter, and made *to work togther*, with facility and rapidity, by one or by two short levers, on the principle of the common "ratchett brace," or by two hydraulic lifting-jacks, acted on from one common pump, or by various other mechanical arrangements. Various forms of adaptation of the screws may be used; that in figs. 1 and 2, and in figs. 12, 13, 14, 15, are preferred. There is no difficulty in firmly sustaining and readily elevating or depressing the heaviest gun by their means. A 68-pounder, of say 100 cwt., will bear upon the two screws, with a dead weight of less than 3 tons, or 30 cwt. for each screw, 3360 lbs. Suppose the screw $\frac{1}{4}$ inch pitch, and moved by a lever of 24 inches effective length, then the combined power of screw and lever will be as 363 : 1, and, allowing $\frac{1}{10}$ the weight extra for the friction of the screw, $3360 + 336 = 3696$, say $\frac{3700}{363}$ lbs., 10 lbs. nearly the force required on each screw to raise the gun. If the elevating screws make two revolutions per second, the gun would be elevated through an arc having a chord of 15 inches in thirty seconds. The elevation or depression may be far more rapid if hydraulic lifting jacks be used instead of screws. The method of elevating and supporting the gun, however, is not confined to screws. The common quoin wedeg, and elevation by handspikes, may be used if preferred, as shown, w w, in fig. 5, in which, with figs. 6 and 7, the mode of resisting recoil by friction on the slide is different from that otherwise here shown.

Fig. 12.



The gun-carriage in each case is mounted on four cast-iron truck wheels. In the arrangements of figs. 1, 2, 3, and 4, the carriage is so contrived that it runs forward on the four truck wheels, but can then, by turning round 90 degrees the lever, *l*, fixed to the axis of the forward wheels, be instantly lowered, so that the bottom edges of the cheeks of the carriage bear upon the racers, or way of the traverse slide, at each side for nearly the whole length of the carriage. These thus become brake-slides. with friction due to the insistent load. After the recoil, by a contrary movement of the lever, *l*, the gun and the forward end of its carriage are raised through the very small space necessary to relieve the cheeks from the contact with the traverse, and to bring it upon the wheels again, and thus it is run forward, free from sliding friction, on the two or four truck wheels with which the carriage may be furnished. This elevation and depression is effected by means of the axis of the forward truck wheels having a semi-rotatory movement in its own bearings, which are placed eccentric to the centre of rolling motion of the wheels which run loose upon the shaft. The effect of giving a quarter or half a turn to the axis is, therefore, to raise the gun and carriage by a vertical distance equal to the throw of the eccentric axle. This simple, though not common contrivance, which gives great facility and power of elevation or depression of any axle through a small space, has been invented and applied by the author to his Patent Turn-Tables for railways with perfect success, where, by its means, good part of the weight of a locomotive engine is readily lifted. Its principle is made clear by the diagrams, figs. A, B, C, D, figs. 8 and 9, and E, F, G, fig. 10, in which the arrangement is shown applied to the ordinary "ship's gun" carriage. The rearmost wheels are so placed as to level, that when the gun-carriage is raised to the highest point upon the forward wheels, as in G, fig. 10, the aftermost ones come to bear upon the traversing slide, and *just clear* the *rearmost* part of the sledges, or sliding lower edges of the cheeks of the gun-carriage from off it; but when the forward wheels are raised *so as to lower that end of the carriage*, upon the sledges, as in E, fig. 10, then the aftermost wheels become slightly lifted off the traversing slide, the point, *s*, F, fig. 10, acting as the centre of motion both ways. In figs. 5, 6, and 7, the gun carriage rests constantly upon the four truck wheels, and the necessary amount of friction to prevent recoil is produced by the gripping by a sort of vice of a mid-feather brake-rail, standing up along the centre of the traverse slide, B.

Fig. 13.



A turn of the lever, H, figs. 5 and 7, of less than 120° is sufficient to grasp the brake-rail powerfully between the jaws of wood, *r r*, fig. 7, of the vice, or to release the gun-carriage from this break by the contrary movement, and any amount of frictional resistance to recoil may be commanded by it.

The cross shaft acted on by the lever, H, has got two steel collars with inclined faces keyed upon it, forming each a single thread of a very strong screw. These bear against a pair of corresponding collars attached to the jaws, *r r*, at their outer sides. The jaws, faced with wood blocks, are, by this arrangement, compressed upon the break rail, and again, when released to let it loose, they open spontaneously, by the spring at the back of the joints above the shaft. The gun can then be run forward freely on its truck wheels. There is no more complexity in any of these arrangements, nor liability to get out of order in service, or be disabled, than in any ordinary gun carriage.

The operations of mounting or dismounting guns upon these carriages would not be more difficult or tedious than with the common ones.

The cost of this gun carriage would but little exceed that of common ship gun carriages, or those for traversing slides in garrison guns, and the cost of the wrought iron level slides would be, as nearly as possible, the same as the present timber ones.

In figs. 12, 13, 14, 15, a form of gun carriage is shown, embracing "muzzle swivelling," but adaptable to the common traversing slide at present in use. The arrangement of the side links and vibrating links beneath the muzzle, are the same as in the preceding, but the side links, *s*, are shortened so as to take on to the trunnions of the usual gun. Outside these, upon the same trunnions, are placed the top eyes of two male screws, with left or right hand threads, which take into the interior screws, in the gun metal nut pieces, *t*, figs. 13, 14, 15. Upon the extension of the latter are cut screws reverse to the former, viz., if the former were right these are left handed, and screw into female screws to correspond, cut in the outer ends of the cross bar, *r r*, figs. 13, 14, 15. When either by spanners or inserted bars, or by any "ratchett brace" arrangement, the two nut pieces, *t t*, are caused to rotate together, they *screw themselves* out of or into the female screws (or nuts), of the cross bar, *r*, and at the same time screw *out of themselves* or *into themselves*, the male screws, *t t*. The effect of this is, that for each revolution of the nut piece, *t t*, the top eye of the screws fixed on the trunnions, elevate or depress the latter by a height equal to twice the interval between the threads of the screws, supposed all of equal pitch.

Fig. 14.

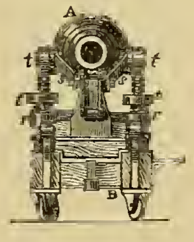
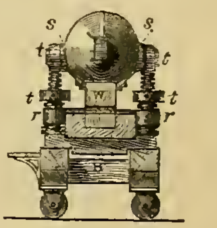


Fig. 15.



This combination of right and left hand screws is, so far as the author's knowledge goes, novel, and offers here the advantage of rapidity in the elevating or depressing of the gun. To avoid complexity in a merely illustrative drawing, the arrangement is shown in its simplest shape, the nut pieces, *t t*, being independently moveable; but it is obvious that they may be connected to move simultaneously by the simplest means, or that their place may, as before, be supplied by the hydraulic jack.

The quoin wedges, w, are brought to bear as soon as the gun is adjusted, so as to take the greater part of the jar off the screws at the moment of discharge. The mode of resisting the recoil by friction at the rear end of the carriage, upon the "racers"—the carriage having here only two truck wheels—is the same as employed in our usual garrison guns, in order as far as possible to adapt the arrangements necessary to *muzzle swivelling* to existing ones "approved by the authorities." This part of the carriage, involving as it does the constant tedious application of "the roller handspike," is, however, by no means recommended by the author, although having the imprimatur of authority.

The outlines of an embrasure, shown in figs. 12 and 13, are not to be understood as representing the form of a stone or any other structure of embrasure, but merely the angular limits horizontally and vertically to which the gun can be trained by the arrangements designed.

FIRE-PROOF DRESSES.

Fire-proof dresses may be viewed under two distinct heads. Those which are of materials rendered more or less perfectly uninflammable, so as to protect the wearer from the personal dangers of catching fire; and those which propose to envelope the wearer in a coating of material, within the safeguard of which he may, with impunity, enter and remain for a longer or shorter time, if not actually surrounded by lambent flames, within range of their radiated heat, the temperature of which, if he were unprotected, would be fatal. A complete fire-proof dress also provides shoes and gloves of such bad conducting material as shall enable the wearer to walk through the fire and not be burnt, or to seize heated matters.

It is remarkable how little has been done to perfect either class, though both present such obvious prizes to the fully successful inventor.

As respects the unimflammable garments of the former class, it has been shown that various salts, phosphate of soda, and many others, possess the property of preventing ligneous tissues, such as constitute the basis of nearly all garments not of animal origin, from burning with flame; the destruction of the organic fibre, and the removal of its hydrogen, &c., until it becomes charcoal, taking place by mere ignition. The rationale of this curious fact is probably due to the extreme sub-division of particles by the interposed ones of the saline saturant, just as the ignited spot or line upon a sheet of tinder produces no flame, but wanders about seizing upon particle after particle of the finely divided charcoal, until all of it is oxidized or consumed, and nothing left but the ashy skeleton.

The process, simple and cheap enough, has, in a few cases of theatrical management abroad, been carried into effect, to preserve ballet dancers from accident, but only under the pressure of authority. It has never come into prevalent use.

It must make the garment unpleasant to the touch, less beautiful to the eye, less readily kept clean, or in some way would appear to interfere with its ordinary use and treatment, so as to cause people "to set their faces against it," as the common phrase is.

Yet whosoever shall effectually and fully carry out this object in a way that every "*pater familias*" shall be able to insist upon his children's clothes being made of material in which they cannot be burnt to death, will largely benefit mankind, and may reap a proportionate reward.

Far less, however, has been done as yet to perfect a dress of the second class—a true fireman's dress; one which, as that of the helmet-diver enables him, to enter and remain in the element of the fish, shall enable the fireman, with as little fear or danger, to enter and abide in the domain of the fabled Salamander.

We may return to this subject in a more systematic manner; but at present do not intend to review the methods from time to time suggested or tried for accomplishing this, which was once a favourite and prize subject of the Society of Arts, Adelphi. We have now merely to notice the latest "notion" that has been promulgated.

The French journals inform us that within a few days a M. Buvert has exhibited at Compeigne, before the Emperor and Empress, a fire-proof dress, encased in which he walked about within a small building constructed chiefly of faggots or facines, while it was thoroughly in flames. The success is said to have been complete, and deemed so by the Emperor himself, who is certainly not a man likely to be deceived by a fallacious trial.

All the information given as to the nature of the dress, however, is that it consisted of a helmet, like that of a diver, with glasses to see through, and apparatus for supply of fresh air (in so far presenting nothing whatever new), and further, that the remainder of the dress is at once water-proof and fire-proof, and is chiefly *composed of sponges* sewed together.

There cannot be a doubt that construction of such material presents a most probable road to success.

A thick garment completely enveloping the person, composed of several successive layers of "hydrolaine" or water-proof woollen fabric, or perhaps of thin flexible leather, with layers of sponge of greater or less thickness interposed, each insulated from the other, and all saturated, or nearly so, with water, or perhaps with some saline solution, would resist the transmission of heat from the outside to the skin of the wearer for a very great length of time. It would even be conceivable that gloves containing layers of wet sponges, so inclosed that the water could not be squeezed out on compression, and formed as respects their *epidermis*, of some incombustible, or badly combustible material, would enable a man to seize, and carry for some time, even a red-hot cannon shot. The use made of common hard old sole-leather, by crown-glass blowers, proves to those who have seen the hands and arms of these men, protected by a casing of this material, from the radiant heat of the "eye" of the "flashing oven," which is sufficient to soften the glass, that an absolutely *incombustible* substance is not indispensable.

But there is no reason why the whole external surface of such a sponge dress should not consist of asbestos cloth, or of another analogous material, which, though applied with success by the late Mr Schwabe, of Manchester, to textile fabrics of a highly ornamental class, has never to our knowledge been before proposed as a substance for incombustible cloth, or for fire-proof dresses, namely spun glass. The fibres of this can be obtained of any length, and from their extreme tennity, possess an amazing amount of flexibility, and bear a degree of rough usage, that our preconceptions of glass in any state do not prepare us for. Spun glass would probably soften and agglutinate at a heat little exceeding that of melting brass. M. Deville of Paris, however, has succeeded in forming "Spun Quartz," *i.e.*, in fusing pure silex by the extremely high temperature of his beautiful gas lamp, and rendering it so liquid that it can be drawn out and wound off in filaments as readily as glass, and has shown that it may be done upon a manufacturing scale, if a use for it could be found. May there not be one here?

Asbestos cloth is older than the time of Herodotus, who says, that the corpses of the Egyptians were occasionally wrapped in it for the last obsequies. His statement, by the way, has given rise to much controversy amongst "the learned" as to whether for the purpose of collecting the ashes of the body in this flexible crucible after incremation, or merely as a final wrapping, of material that should, after embalmment, defy the "tooth of time"—which, as Bacon with a wonderful foresight of "eremacausis," as Liebig calls slow decay, says, "is as a lambent flame." But either the production of cloth of asbestos is "a lost art"—a sort of loss that we are not sure ever existed—or has been a very unimproved one; for at present no one seems capable of forming it in pieces of more than a few inches square, and these no way remarkable either for uniformity or toughness. At Chiavenna, a few miles to the north of the Lago di Como, the mineral, of fine quality, abounds in the highly magnesian rocks of the neighbourhood, and a small manufactory exists, or did exist a few years ago. Sheets of about a foot square were produced of a fabric about equal in thickness and coarseness to the heaviest and worst sacking canvas. The cloth, of which we possessed specimens, contained no vegetable matter mixed with it, nor was the fibre, as stated in all the books, previous to being woven, saturated in oil. The process was, however, kept secret; and the small size, and especially the short length of the pieces, was probably only owing to imperfect machinery.

It is not unlikely that a very serviceable fire-proof cloth, having very slow conducting powers, and applicable to a great variety of important uses, as well as to dresses, might be spun and woven of a combination of the "long staple spun Quartz" with the "short staple" Asbestos. The real difficulties of applying the latter alone, appear to be its shortness, and still more its inequality of length of fibre, the roughness of adherent mineral particles to the otherwise smooth sides of the long, silky crystals, which prevents its being properly "carded," and imperfect and unequal flexibility, and consequent toughness, due to difference of diameters of the crystals in every natural "faciculus."

If such a cloth could be produced cheaply, and so that it could be used (if even interlaid between two protecting sheets of canvas saturated in saline matter to prevent their burning with flame), it would afford a fabric of the utmost possible service and value wherewith to make covers (tarpaulins we must call them) to throw over, and to separate heaps and masses of combustible merchandise in our docks and warehouses.

A thin sheet of incombustible cloth placed around and over such materials as jute, hemp, cotton, gums, oils, drugs, &c., in place of the dry wattled hurdles, or still more combustible tarpaulins at present used, would for a long time prevent ignition from surrounding conflagration, and might be used as a subsidiary mode of separation or subdivision in warehoused goods. But we have rather digressed. An efficient fire-proof dress is undoubtedly still a desideratum; for occasionally, and not very unfrequently, conditions always will arise in which human life, or property highly precious, records or volumes irreplaceable, account books of banks or merchants, plate and jewels, and a thousand other things, might be rescued from destruction by fire, if the courage of the fireman were seconded, by his possessing a dress and apparatus, in which he knew by experience that he was safe from suffocation, and from being roasted alive. A limit, however, is placed to the use of such dresses in the interior of our burning buildings, by a consideration that seems never to have entered the minds of their successive contrivers. The greatest dangers to the fireman that ventures within the cincture of "a fire" are—the uncertain footing of the crumbling floors and burnt timbers beneath his feet, and the imminent and instant chance of being knocked down, stunned, or overwhelmed by the fall of bricks upon his head.

Against these, no preventive has, so far, even been proposed. Might it not be possible to produce a sort of covered "flying sap" of steel-arched plates that could be rapidly run forward, piece by piece, and beneath which, like the ancient besiegers beneath the "testudo," the very heart and centre of a conflagration might often, if need were, be reached by the fireman, secure in his panoply of watery sponge, and breathing pure cool air, driven forward, through a tube, to him by proper apparatus.

In conclusion, it may be noticed, that the proposal to apply wet sponge to those purposes is not quite new. In Comptes' Rendú de l'Academie des Sciences de Paris for 1830, an account is given of trials of dresses not very unlike those of M. Buvert, by the Marchese Origo, on the firemen at Rome. Several of these men are said to have remained fifteen minutes in a burning house without inconvenience or any effort except the elevation of the pulse from 70 to 125 beats per minute.

MESSRS RENNIE'S PATENT FLOATING DOCK.

Those who have gone up or down the river during several months past, must have noticed an enormous structure of iron whose solid mass towered high above the surrounding buildings of Greenwich, and shut out most of the horizon from the water. The gigantic rectangular mass, however, suggested nothing as to its intended purport, and hence few have been acquainted, until very recently, with the facts that one iron floating dock of the very largest class has been completed, and is now being taken asunder and sent to its destination, and that another, even somewhat larger, is being proceeded with, in the works of Messrs George Rennie & Sons, between Greenwich and Deptford.

These docks are being executed for the Spanish Government, from the designs of Mr G. B. Rennie, M.I.C.E., who has patented the improvements which they combine. From a recent examination of the work by the writer, it is not more than is merited (though that is high praise) to say it upholds the hereditary renown of the Rennies.

There is nothing very novel about the dock, in the usual sense in which novelty expresses a wide or fundamental departure from the means previously adopted to attain a given end; but in that best sense of "novel" in relation to practical accomplishments, in which new methods, materials, and arrangements are skilfully and judiciously combined to carry out with perfectness ends and applications before imperfectly attempted, it is a novelty and an improvement.

The very many contrivances under the names of dry or other docks, by which the immersed body of a ship may be laid dry, and got at for repairs, &c., are all divisible into three great classes:—

1. Those in which the ship is floated into some enclosed space, and the water surrounding her then removed by drainage or pumping, &c. The "Grid-iron" is, in fact, only a modification of this class—where the fall of the tide does the whole work of pumping.
2. Various arrangements by which the floating ship is dragged by directly applied power out of, and above the level of the water.
3. Arrangements by which the surplus buoyancy of another floating body is brought to bear upon the ship in such a manner as to lift her out of the water.

To this first class, belong the old fashioned "Dry or graving dock," and to it would most properly also belong the American dry dock proposed by Caldwell. An extremely simple, and in certain positions, excellent device.

It consisted, in fact, of a double-chambered lock, with two pair of gates. The first, or entrance chamber, was constructed with its sill at a sufficient depth below the permanent or high water level of the water of the place to allow the ship to float in, and the first set of gates to be closed. The "lift" between the entrance and second or upper chamber was such, that upon water being permitted to flow into both chambers from a higher level than either, the ship could be floated from the entrance, into the second chamber. The latter chamber, when then run off dry, and the ship grounded upon keel blocks ranged along its bottom, became in effect an ordinary graving dock, gravitation doing the work of pumping out the water. When the ship was to be undocked both chambers were again sufficiently filled, the vessel floated out into the entrance chamber, which was then run down to tidal level, and she issued out.

In places like Greenock, for example, where a natural supply of water at a moderate elevation above the sea can be commanded, this method seems to offer several advantages, and even where pumping into an elevated reservoir must be employed, it would offer the decisive one—that the pumping may be done during a long period by a very small power, and the water be stored, while the ship can be docked or undocked in a few minutes, and so without the loss of 3 to 6, or even 10 or 12 hours occupied often in gradually pumping out the usual graving dock.

To the 2d class appertains Morton's Patent Slip, the American Screw and Hydraulic Docks, Mr R. Mallet's Ship-lifting Dock, an account of which was given several years since to the Institution of Civil Engineers, where a model of it is preserved, Scott's Hydraulic Dry Dock (see vol. iv., 2d series of this work), and Mr Clarke's improvements and modifications thereof, as executed and in use at the Victoria Docks, London, and many variations and combinations of the parts of these, forming the subjects of more than a score of patents in the United States alone.

These plans possess all certain radical defects. The Patent Slip strains the frame of timber ships nearly as much as the plunge into the water from the old launching ways was known to do. The ship is never on an even keel, the supporting points are not susceptible of very nice or often even of safe adjustment under the bilge, to get a ship "cradled," with the least sea on at the tail of the slip, is hazardous; and, besides other objections that we will now pass, it has this one in common with most of its class, that it concentrates the severe strain necessary to lift the ship out of the water upon a single, or, at most, on one or two points, the giving way of which, or either of them, may produce disaster.

This is, indeed, the great evil of the American Hydraulic Dock, in which a large number of vertical suspending chains distributed along each side of the platform over which the ship is floated, and which lifts her upon its surface, are all concentrated into two horizontal chains at last, which are made fast to the piston rods of two hydraulic horizontal cylinders. Anything going wrong with either of these becomes fatal to the further use of the dock. To palliate this defect, the American Screw Dock proposes to distribute the whole load of platform and ship by suspension from a great number of simultaneously moveable vertical screws, of great size, and, of course, of great length, where the draught of water of the ship is large. Here, however, though so much is gained, that the failure of any one part is not attended with the chance of destruction to the ship by her falling over on one side against the side piling or wall of the dock, this evil remains, that the refusal to act further in any one screw renders nugatory all the others for the time being. Mallet's dock or lifting arrangement, in part, got over both evils, and had this theoretic advantage, at least, that the power at the point of application (the platform, which was raised, and, at every point of its elevation or lowering, was sustained, without the possibility of falling back, by a peculiar adaptation of the "Toggle joint,") always increased in the same ratio as the weight to be raised increased, i.e., as the ship was raised out of the water. It still, however, concentrated the strain, although thus equalised; upon two points, the total failure of either of which was fatal for the time to the use of the "ship lifter," though not attended with any possible accident to the ship herself. Scott & Clarke's hydraulic docks aim at the distribution of the bearing points, by multiplying the number of hydraulic cylinders, and placing them vertically along both sides of the platform to be raised; but this distribution is little more than apparent. The connecting link between all these points of strain at both sides of the dock is the thin column of water in the long and many tubes with valves, &c., communicating between each and every one of these hydraulic cylinders, and the pumps at the engine-room, whence the water is injected into them all. The piston or pistons of these pumps is in reality the final "point d'appui" upon which all the partial strains are concentrated, in such a way that failure there is also failure at every point of support, or of elevation.

It is not to be denied, however, that of all the forms of apparatus for *dragging* a ship out of water—hitherto constructed, the last is probably the best.

To the third and last of our classes, however, unquestionably belong the most perfect, safe and truly scientific, ship lifters; those in which by proper combination, gravity is made to vanquish gravity, and where the diffusion of strain may be as uniform, and as complete as the action of gravity upon a level sheet of water.

The raising to the surface a sunken ship by slinging round her sides, and undergirding her bottom, with empty closed casks, must have been a very old affair, almost as old as the similar use of inflated skins, or empty earthen pots, in Mesapotamia and India, for ferrying heavy bodies across unbridged rivers. It was probably this that suggested to the Muscovites, at a very early period of their European career, the construction of "The Camel"—to enable them to get their men-of-war, with a large draught of water, temporarily to draw so little, that they could pass over the bars and shallows of Cronstadt and of the Neva. "The Camel" was used at Amsterdam also, as early as the beginning of the seventeenth century; and, we believe, is not even yet wholly superseded, to pass deeply laden ships over the banks at the mouth of the Wye. Several huge wooden pontoons, each having in transverse section a flat floor and deck, one plumb side, and the opposite one sloped off, more or less, to fit against the side and bilge of the ship, were brought parallel to each other in two ranges; strong cables from capstans on the decks passed down through diagonal hawse pipes, and deep sunk in the water, ran from each range of pontoons to the opposite ones as they floated at anchor. The ship destined to get the desired rise in the world, was then floated in between the two ranges of pontoons, or camels. The capstans were manned and all the cables hove taut simultaneously, with the effect of first bringing the pontoons close up against the sides of the man-of-war Then, as the undergirding cables came up against her keel as it lay above their great under water pontoon, they forced her up out of the water; until the cables were brought nearly straight beneath, and the floor of the pontoons was not far from on a level with that of the ship. Thus these "ships of the desert" or "Camels," (however they came to be so called), bore upon their backs the early navy of Russia into and out of port. It needed no great stretch of further invention to see that these pontoons might be so altered, that partial repairs to a ship's sides might be executed while thus upheld; or that with or without the help of some rise of tide, a ship might, by their means be even laid up, high and dry. Indeed it is more than probably that "The Camel" was thus actually used occasionally by the Russians as an instrument of repair, and such a use appears to have at least occurred to the active mind of Professor Robison of Edinburgh, himself a practical seaman.

It would be beyond our limits to notice the many rude and now barbarous looking contrivances more or less based on this method, that are still to be found here and there round the almost tideless shores of the Mediterranean.

Analogous conditions in nature forced the attention of Americans to substitutes for the old "graving dock" of European dockyards, before any considerable amount of improvement in floating dry docks had been made by ourselves. They, indeed, have been, to a great extent, our teachers on the subject, though we have now outstripped them.

In 1834, a Captain Thomas, of the U. S. navy, patented "a sectional floating dry dock," which consisted of a number of pontoons of timber parallelopipedal in form, which were arranged parallel to each other, in sufficient number to equal the length of the ship to be raised by their combined breadths. They had "side chambers," *i.e.*, at the ends of these pontoons, capable of being filled with water, or of being pumped out. The whole combined mass could be sunk below the surface, sustained by the buoyancy of certain parts remaining above, until a ship was floated in over, with her keel thus crossing all the pontoons, which, by pumping out were then raised, and brought the ship up with them, above the surface level. In 1857, Captain Thomas patented further improvements, by which he substituted for some of these "side-floats" "end-floats;" in a word, provided the means which his first arrangement stood wholly in want of, by which the floating mass could be kept upon an "even keel," when unequally loaded, by raising a ship whose centre of gravity during any part of her ascent was not in the vertical passing through the centre of buoyancy of the dock. His pumping arrangements were however very defective.

In 1841, Messrs Burgess & Dodge patented important improvements upon the arrangement of the pumping apparatus and the "end floats." Still the whole scheme was amenable to this objection, that it could deal but with one ship at a time, and was useless for anything else while even that one vessel might occupy it. In 1843, Messrs Dakin & Moody devised, in their "platform basin and marine railway," and patented a contrivance, by which the floating dock should be used for its legitimate purpose of raising the ship only; which, when raised to above surface level, could be slided off the deck, or united floor of the dock, and on to dry land, upon suitable lines of railway prepared to receive and sustain the load. From these, when again to take the water, the ship was transferred back to the floating dock, which, sinking with its load, left her riding upon her own element again.

By the latter end of 1849 docks of this character had been so far perfected in detail, and their practical value established by private enterprise, that the United States Government commenced the construction of the "section floating dock" at Philadelphia, and afterwards of the Californian dock, and finally, some years after, of the Portsmouth and Pensacola "balance floating docks," which latter are, in fact, the prototypes of the iron dock patented by Messrs Rennie.

In a rapid notice, such as the present, it is impossible to analyze the varieties of constructive detail of these United States docks. We must refer to the large work, "The Naval Dry Docks of the United States," by Stuart, fol., New York, 1852., where they are well described and illustrated. They all have the same common principles, gradually improving in constructive detail, from the first shaky-looking and disconnected agglomeration of hulks—the Philadelphia dock—to the last at Pensacola, which approaches most nearly to Messrs Rennie's construction, though immeasurably inferior in every respect to the latter.

All these American docks labour under the formidable defects due to construction in timber—probably the only material there available at the period—and it is the substitution of iron for timber that gives to the dock, the subject of the present notice, its first and most characteristic advantage. Hollow structures, intended to be not only water-tight, but more or less *air-tight*, of the enormous dimensions of these timber floating docks, strained by the unequal bearing of loads, reaching to two thousand seven hundred tons, and confined almost along a single middle line of bearing, perhaps in rough or disturbed water, and subjected to all the vicissitudes of season in a rigorous climate, cannot, except by never-ending repairs and expenditure, be kept even water-tight alone; and, by their necessities of function and of structure, deprived of the means of that free ventilation, that, even in sea-going ships, is found scarce sufficient to stave off dry rot, they must decay and perish rapidly.

The very conditions and form indispensable to these floating docks unfit them for construction in wood, or, at the least, render their structure weak, flexible, and leaky, even in the hands of carpenters as good in design and in execution as are the Americans.

All these evils disappear in iron. In the accompanying engravings, we have given a general plan, fig. 1, and partial longitudinal section, fig. 2, with half-end elevation, fig. 3, and half-transverse section, fig. 4, of Messrs Rennie's dock, and in the diagram (not to scale), fig. 5, have shown the plan of the landing berths.

The dock consists, at its lower part, of one huge wrought-iron pontoon, of 12 feet deep, 109 feet wide, and 350 feet in length, from which, at either side, grow up the hollow boxes of plate-iron forming the sides, plumb externally, and sloping towards the centre of the dock to the inside, while above these the sides rise plumb at both sides to the level of the top. The whole hollow structure is crossed at frequent intervals by lattice-work, forming so many transverse girders, of which, of course, the outer skin constitutes so much of the top and bottom webs. The internal trussing of the sides is also well-united with the transverse lattice-work of the lower part, and from the level of the broad gangways at the top of the inclined sides—which answer to the "broad altars" of the old graving docks—down to the bottom skin a continuous system of lattice-work extends from end to end, and, with the plating, &c., of the extreme outer sides, and of the inner vertical and inclined ones, serve to give longitudinal stiffness to the whole as a single pontoon. Several other lattice-webs run from end to end of the bottom or flat part. The whole, from bottom to top, is divided by water-tight bulkheads, into ten compartments. The extreme top part of the sides, for a depth of 3 feet from the top surface—upon which the pumping engines, &c., are placed—consists of permanently closed and air-tight cells, whose capacity is such, that, with all the rest of the interior of the dock filled with water, these cellular spaces are sufficient to float it about level with the lower surface of the cells in sea water.

Fig. 1.

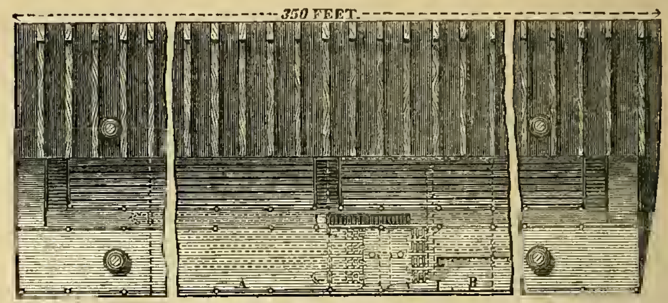
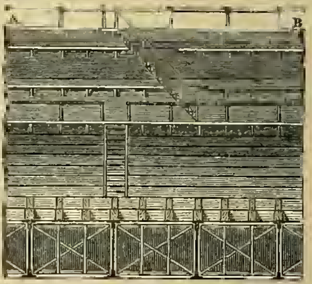


Fig. 2,



The dock is always open at both ends, so that it can receive a ship much longer than itself if need be, and always free from any interference with her spars.

The whole flat surface forming the floor of the dock is planked with thick teak above the plating, laid longitudinally, and bolted through (which, *en passant*, seems almost the only defective bit of detail about the work, and must be always liable to leakage), and over this is laid the transverse sleepers, also of massive teak, upon which the "keel blocks" of the ordinary wedge construction are to be laid. Upon these also, with sliding plates, ratchets and palls, will be placed the "bilge blocks," provided with means to bring them in beneath the ship as the dock rises beneath and brings her out of the water.

Fig 3.

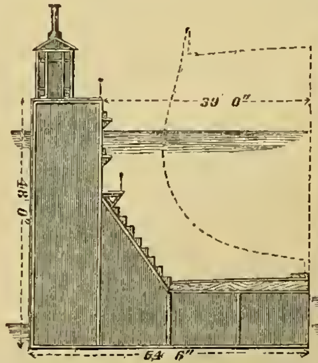
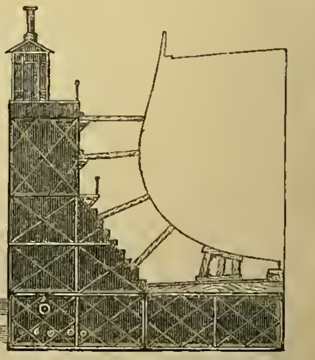


Fig. 4.



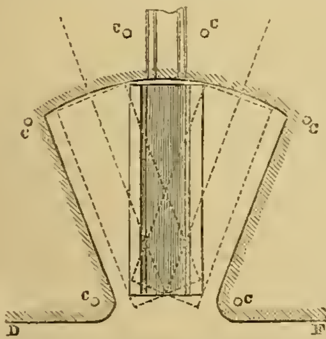
The inclined inner sides throughout their length are traversed at vertical intervals of about 30 inches by strong teak planked gangways, sustained by iron bracketing, which, with the broad gangways above, give facility of access, &c., and for placing the struts against the ship's sides in being docked. There are two similar continuous gangways along the inner vertical sides higher up.

Similarly disposed at either side of the dock, and upon the top of all, are placed the steam-engines (horizontal and high pressure) to work the pumps for emptying the interior chambers of water when required. The pumps are ordinary lift pumps, eight in all, four at either side. Entrance passages are provided by which water from the outside can be admitted, and caused to flow into any one at pleasure of the separate compartments. And conversely (as will be observed by dotted lines on the plan,) the suction pipes of the pumps are so arranged that the water can be pumped out more or less at pleasure from any one or more, or from all uniformly, of these compartments.

The whole of the hand gear actuating all this apparently complex, but really very simple system, is placed conveniently to the hands of the two engine-men upon the top at either side of the dock 48 feet above the extreme bottom. The hand wheel, acting by a screw upon each sluice, shows by inspection how much it is open, while a corresponding system of floats show, upon a proportional scale and index, the actual depth of water in the compartment to which that sluice belongs, and the rate of its ingress or egress. By these means it matters not how unequally or unevenly the ship bears upon the dock, the latter can always be preserved to an even keel, *i.e.*, the floor always kept horizontal.

The method of using this dock needs but little description. Supposing it with the ship about to be lifted, both in deep water; the ingress sluices are opened (if the interior be previously empty), and water admitted until the whole structure sinks to near the level of the lowest part of the top air-tight cells. The ship is then warped or "steamed" into the space between the sides of the dock, and brought fair over the keel blocks. The water is now pumped out, with the precautions and by the means provided to preserve an even keel, and gradually the dock rises, bringing the keel blocks first up in contact with the ship's keel, then, with the bilge blocks pressed in against her sides and bottom, finally lifting her clear out of the water, where, as one with the dock, the whole remains floating horizontally and permanently at the high water line. The dock has then a draught or immersion of about four feet.

Fig. 5.



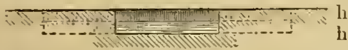


Fig. 6.

It is needless to describe the well known operations of putting in the struts between the ship's sides, as she comes out of water, and those of the dock, or the reverse set of manipulations by which when the repair has been executed to the ship, she is recommitted to the deep.

The merits of this work consist mainly in the happy reduction of the floating dry dock principle to its simplest elements, and in the skilful way in which the most suitable of all materials, iron, has been combined in its construction, so as to afford rigidity, strength, and permanence.

By very masterly arrangements in the pumping apparatus, the conditions are met in a manner at once simple and perfect, and the mass of complicated clamjamphery that deforms the American docks got rid of.

So far, however, this dock can only apply itself to one ship at a time. In the diagram, figs. 5 and 6, is shown the plan proposed by Mr G. B. Rennie (to whom the general design of the dock is understood to be due, while its details of execution have been ably carried out under his direction by Mr Rae, acting for Geo. Rennie and Sons), for enabling the one floating dock to pay its "devoirs" to three, or even to any number of ships that the time upon its hands would allow of.

One, or several sector-shaped shallow basins, with narrow entrances from the deep water outside, are formed. The perfectly flat floor of this basin is formed of masonry blocks laid upon a proper foundation, and capable of sustaining fully the weight of the dock and its superimposed load when grounded upon the bottom. The basin has a depth of water and a few inches to spare to enable the dock to be floated in when at its light draught. Water is admitted, and it is then grounded, and when resting on the bottom, the ship will be at a level suitable to be drawn off, and on to rails placed upon the land. The empty dock—again floated by pumping out a few inches only of water—may now be hauled out to take on another ship, which, when brought into the basin, may be similarly taken off on land by the rounded end of the dock, as shown in fig. 5, being presented to another part of the curved side of the sector-shaped basin.

Such is one proposed arrangement for hauling off the ship upon rails (as practised in America). The Messrs Rennie propose, however, some modifications, not yet put into hand, that promise materially to improve this portion of the work

These floating docks, however, are not intended by the Spanish Government for prolonged or extensive repairs, but rather for such as occupy at most but a few days, and hence it is probable that the capabilities of each dock alone, will be found, for a long time at least, sufficient for their respective stations of Carthagena and Ferrol.

ON THE HYDROSTATIC PRESS AND ITS APPLICATIONS.*

The enormous power of the hydrostatic press has been invoked to overcome mechanical difficulties in vast enterprises, as on the occasion of the placing of the Britannia and Conway Tubular Bridges, the launching of the Great Eastern steamer, and other similar operations which have been rendered necessary by the exigencies arising in civil and mechanical engineering. The ingenious applications of water power to hoisting machinery introduced by Sir William Armstrong, and the hydraulic lifts for vessels, which are made to answer in place of the dry dock and patent slip, are now being extensively adopted. The limits of the present paper will not allow more than an allusion to the operations just mentioned, as any one of these subjects would in itself afford matter for a lengthened disquisition.

Few persons are probably aware of the number and interesting variety of the purposes in manufactures and commerce to which the hydrostatic press is applied in the present day.

In the year 1785 a patent was granted to Joseph Bramah, enginemaker, of London, for a "new invented hydrostatical machine capable of becoming the primary or first cause of motion in all kinds of inanimate movements whatsoever, and which may be employed, instead of pumps or any other hydraulic engine, for the purpose of raising water through any given space."

This was the invention which has been known as Bramah's Hydrostatic Press, so simple in its operation, so powerful in its effects, and so universal in its application to modern manufactures.

The property of fluids, by means of which the hydrostatic press derives its power, has been long known under the name of the hydrostatic paradox. In mechanics there is a principle called the law of virtual velocities, according to which a small weight descending a long way in a given time is equal in effect to a great weight descending a proportionably shorter way in the same space of time. The property of fluids alluded to is analogous to the one in mechanics, and may be thus stated—a small quantity of water descending in a long column is equal in effect to a proportionably great pressure caused by a large volume of water in a short column.

This property of fluids was not brought into full practical use as a powerful agent until Mr Bramah invented a simple and ingenious method of making a packing water-tight under heavy pressure between the interior of a metallic cylinder and the exterior of a metallic ram fitting therein. The ram leathers, by which this is effected, will be described when we speak of the parts of a press.

Suppose a vessel with two perpendicular open ends of cylindrical form, having pistons fitting therein, the smaller piston being one circular inch in area, and one pound in weight, and the larger being 144 circular inches in area, and 144 pounds in weight, with water in the vessel below the pistons, it is clear that the one pound will balance the 144 lbs, and it is also evident that the slightest force applied to the top of the small piston will raise the 144 pounds. It may be necessary to observe, that in this illustration we leave out of consideration friction, and suppose the pistons to be water-tight. Bearing in mind the illustration just given, we pass on to the working parts of a small hydraulic press for experimental purposes. The following are the different parts in detail:—A pump cistern having water therein, a pump with solid piston worked by hand lever or by engine power as the case may be, a rose pipe for preventing the admission of dirt into the barrel of the pump, the lower valve, on the ball principle, which opens to admit the water when the piston rises, and closes when the piston descends, the upper valve which opens when the piston descends, and closes when the piston rises, the safety-valve which has a connection with the lower valve so as to raise the ball when the pressure arrives at its limit, the let-off valve, the pipe to convey water to the press, the cylinder, the ram, the space for leather, the leather ring for making it water-tight between the cylinder and ram; the water under pressure rises upwards and squeezes outwards each way the sides of the ring, and thus a water-tight joint is made—a most essential and important provision—the table of the press upon which are placed the articles to be pressed, the pillars, and the top. In a large press there would be a bottom separate from the cylinder, but in the example the pillars are attached to the cylinder itself.

I now leave the first division of the subject, and pass on to the second division, in which it is proposed to allude to the varied and numerous applications of the hydraulic press, giving a more minute description of some specific processes and apparatus, combining more or less of novelty either in application or design.

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* Read at the British Association, Manchester. By Mr E. T. Bellhouse, of Manchester.

It may prove interesting to notice, firstly, the packing of Manchester goods by steam and hydrostatic power. Twelve or fifteen years ago the most extensive of our shipping warehouses required for packing purposes only two or three hydrostatic presses of 5, 6, or 7 inches diameter, worked by hand pumps.

The Manchester warehouses of the present day require steam-engines of considerable power, specially for driving the presses and hoists. One Manchester shipping warehouse may be instanced, in which the engine power equals 30 horses. There are 24 pumps of $1\frac{1}{4}$ inch diameter; there are 12 presses of 12 inches diameter, and four smaller ones, and 8 hoists are used, the whole worked by steam power. By this arrangement of apparatus the surprising number of 450 bales, about 4 cwt each, can be packed completely in 10 hours, being equal to 90 tons of Manchester goods. The enormous pressure of 5000 tons can be exerted by these presses and apparatus at any given time.

For packing bales of wool in Australia and cotton in Egypt, 7 or 8 inch hydraulic presses are used, having boxes in which the material is pressed. The presses are worked by ordinary hand pumps. There are generally two boxes, so that one may be filled with cotton whilst the other is under the pressure. The boxes run upon wheels and a railway; the upper part is hinged, and there is a loose bottom, which is pushed upwards by the press table, when the box is in the proper position for pressing. When the pressure is on, the hinged sides are opened, and the cords are fastened round the bale. The table is then lowered, and the bale rolled out. The box is now withdrawn, and the other one, filled in the meantime, is brought under pressure.

In India cotton packing presses of enormous power are required, as it is necessary, from considerations connected with the question of freight, to compress the cotton to such a bulk as shall cause one ton weight to equal the measurement allowed for a ton, namely, 40 cubic feet.

One of these presses manufactured by the firm with which the author is connected is upon the compound lever and hydrostatic principle, and anything relating to the subject of cotton supply from India is rendered interesting in the present juncture of affairs, when our supply from the States of North America is so uncertain. The iron box is filled with cotton to the depth of 13 feet, pieces of canvas having been laid below and above the cotton. An ironplate, having grooves for ropes on the under surface, is forced downwards a distance of 9 feet 8 inches by means of a worm working into a toothed quadrant, acting upon a knee-jointed set of bars. The peculiarity of this arrangement is, that the quadrant and the knee-jointed bars all arrive at the most advantageous position for exerting power at the termination of the stroke, when the cotton is in a smaller bulk, and requires great pressure.

Doors are now opened just above the point where the descending cover has stopped, and strong iron blocks, in a slightly tapered form, are pushed in so as to prevent the cover from rising. The table of a powerful hydrostatic press, having grooves on the upper side for ropes, has so far served as the bottom of the cotton box, and the hydrostatic pressure is now put on, and causes the table to rise 2 feet, compressing the cotton into a space of 1 foot 4 inches. Doors are opened at the front and back of the lower part of the box, and ropes are passed through the grooves in the ascending table and descending cover, and the bale is completed, the finished dimensions being 4 feet by 1 feet 4 inches by 1 feet 4 inches, and the weight 4 cwt. A steam-engine works the knee-joint and quadrant motion, and also the power pumps for the hydraulic cylinder. The diameter of the ram is 18 inches, and the rise 2 feet, and the pumps are made to suit the requirements of speed and power.

This press will turn out with ease 80 bales in 10 hours. One of the advantages of this kind of press consists in the fact, that although the loose cotton is put into the press box from the upper floor, the packed bales are delivered on the ground level. The author considered this to be a much more desirable arrangement than when the bales are delivered on the upper floor, as in a press which packs entirely by an ascending motion with a single hydraulic cylinder. They are also made with two cylinders. The length of rise of these presses is 12 or 13 feet.

In 1854 it became necessary to send out vast quantities of hay from this country to the Crimea for the use of the British army, and a complete system of packing by hydraulic presses and steam power was arranged by which 250 bales of $1\frac{1}{2}$ cwt were packed each day of 12 hours. The apparatus here alluded to was put up in a temporary way, and afterwards more complete sets of apparatus were set to work at London, Manchester, Liverpool, and Bristol.

The Liverpool apparatus consisted of a 16 horse boiler, 12 horse engine; 3 sets of hydrostatic pumps, having 4 plungers each. Six presses, each exerting a force of 90 tons, and three presses, each pressing 190 tons. The pumps worked by steam power communicated with pipes going to each press, and a series of stop and let-off cocks were the means by which all the operations of pressing and lowering could be instantaneously and simultaneously effected to any of the presses during the process of packing. An efficient and simple plan of telegraph between the presses and pumps was found useful. Three ordinary trusses of hay were first made into one by the smaller sized presses, and three of these were put together in the larger presses and made into bales of 4 to $4\frac{1}{2}$ cwt, the dimensions being about 3 feet by 2 feet by 2 feet. About 200 bales of this kind were packed, bound with hoop-iron, and trimmed each day of 12 working hours.

The hydrostatic press is now generally used to extract the oil from rapeseed, linseed, and hempseed. For these seeds the press works vertically, and there is a series of iron boxes in which horsehair bags filled with seed are placed, and the oil is forced by the pressure into the troughs and a cistern. Other varieties of the hydraulic press are required for olive, almond, and nut oil.

In the manufacture of stearine candles by Mounier & Boutiguy's process, the hydrostatic press is used in two forms. The thin cakes of fatty acid which have been purified and prepared are placed, with thin zinc plates interposed here and there, upon the table of a vertical hydraulic press of 12 inch ram. The press is worked very slowly at first, and a considerable portion of the oleic-acid is removed, in the course of three or four hours, and received in troughs and cisterns. The cakes are taken from this cold press and are put into horsehair bags, and inserted between metallic plates in a horizontal press having a 16-inch ram. This press is so arranged that during pressure the cakes are enclosed in a chamber into which steam is admitted. The hot press operation lasts about one hour.

In the breweries the essence is expressed from the hops by the hydrostatic press. The hops are put into a perforated cylinder, into which the table rises or descends as the case may be, and the liquor falls into the receptacle provided to receive it. In the tanneries a similar press is used to extract the essence from the bark.

In the manufacture of clay pipes or tubes for drainage and water supply, the hydrostatic press is used in the following manner:—The cylinder and ram are placed above, so that the pressure is in a downward direction. Upon a moveable stage are fixed two iron cases, which can be brought alternately under the piston attached to the ram of the press. These cases have at their lower extremities conical moulds, which can be changed according to the nature and dimensions of the articles to be manufactured. When one of the cases has been filled with the clay in a sufficiently plastic shape, it is placed under the piston of the press. The clay is there forced through the apertures left between the internal and external conical moulds, whence it issues in the required form, and is cut off in lengths by means of a wire. When one case is emptied, it is withdrawn, and the other case, filled in the meantime, is brought under the press. The tubes made by the hydrostatic press are sufficiently strong to bear an internal pressure of 1000 lbs on the square inch, which is very considerably stronger than the tubes made by the process formerly in vogue.

Somewhat analogous to the making of clay tubes is the manufacture of lead and pewter pipes for plumbers and gasfitters. This is a very interesting process, as the nature of the material renders necessary some ingenious expedients, and the power required to be exerted is very great.

The lead pipe press may be arranged to work either vertically or horizontally. On the ground stands a strong hydraulic cylinder bored throughout its entire length, 19 inches diameter. The ram is not solid the entire diameter of cylinder, but has nearly all its length turned less so as to make a water space on the upper side of what may be called the piston, as well as on the bottom. By this means hydraulic power will work the ram either way. Connected with the cylinder by wrought iron pillars is a heavy casting called the container, having a hole about 6 inches diameter through it, into which the top of the press piston fits with great accuracy. In the upper part of the container is a chamber with preparation for securing the winged block in which the dies for pipes are fixed. There is a fire-place surrounding the container to keep it in such a state of warmth as to prevent the molten metal from being chilled when poured into the container. When the container has received the molten metal, the winged block and dies are put into place, and on the rising of the hydraulic piston the pressure is communicated to the molten metal, and it is forced through the dies in the shape of a continuous pipe. The management of the dies, the adjustment of the proportions of the container, and other parts of the machine, and the attainment of the proper temperature of the molten metal, are all essential points to secure the successful use of the lead pipe press.

In the region of the River Plate, South America, the saddles require very handsome leather coverings, which are usually worked to an elaborately ornamental pattern by means of hand punches and stamps. This is a very expensive process, effected much more expeditiously and economically by means of the hydrostatic press. A number of carefully engraved metal plates are placed with the leather between, and with blanket at the back of the leather upon the table of the press, and the ornamental design is pressed on the surface of the leather when the hydraulic power is applied.

A very common method of proving beams and girders of iron is that of connecting the ends of the two together by tie-rods, and placing the cylinder and ram of a hydrostatic press between them, keeping a register of the pressure applied.

Fig.1.

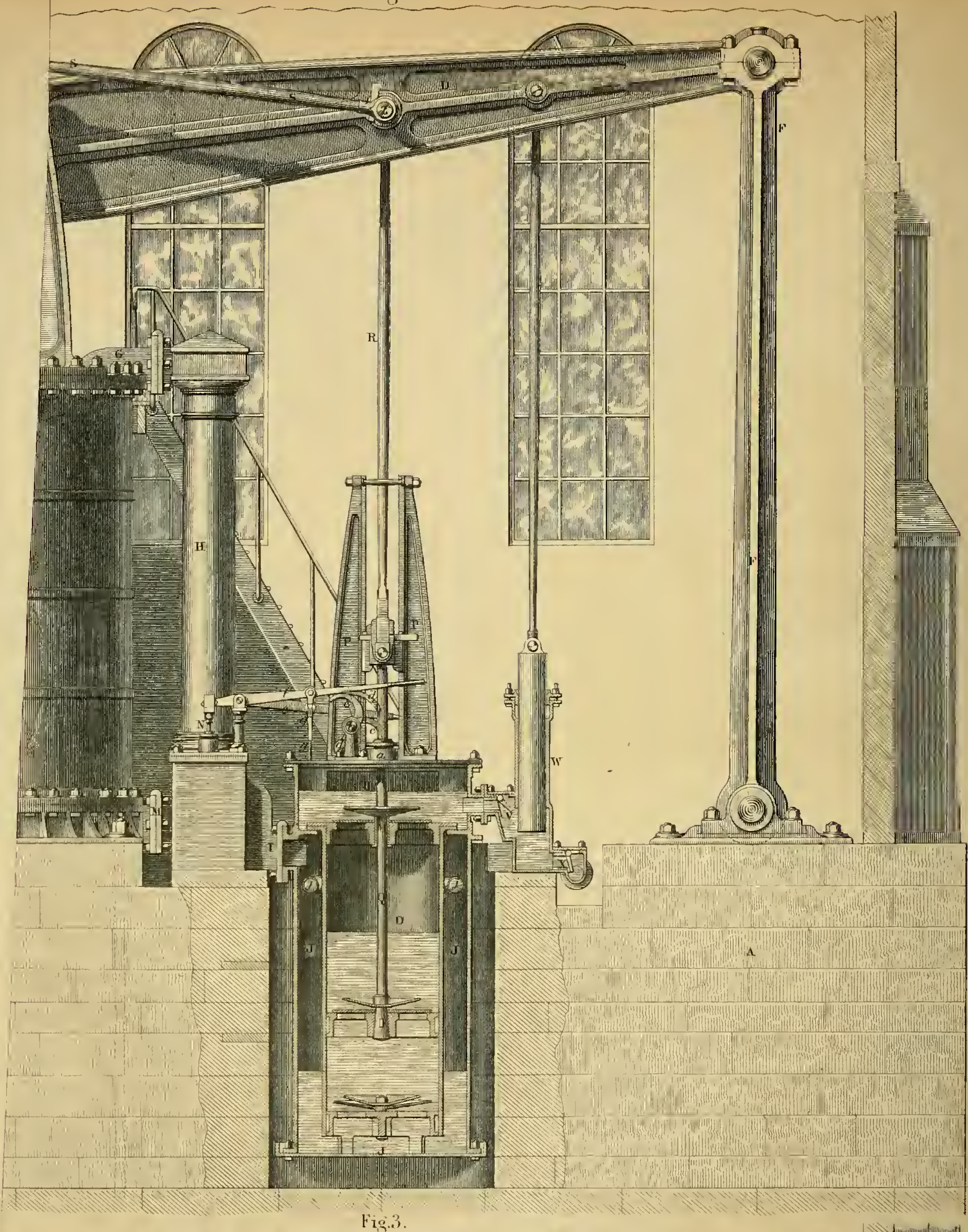
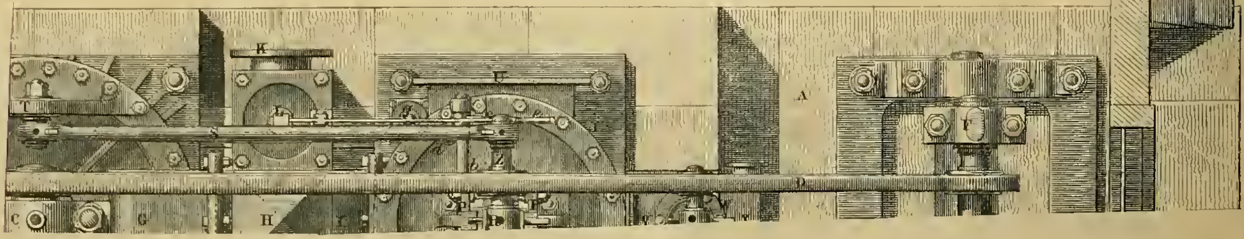


Fig.3.



PUMPING ENGINE,

BY ANDREW BARCLAY, *ENGINEER*, KILMARNOCK,
PATENTEE.

Fig. 4.

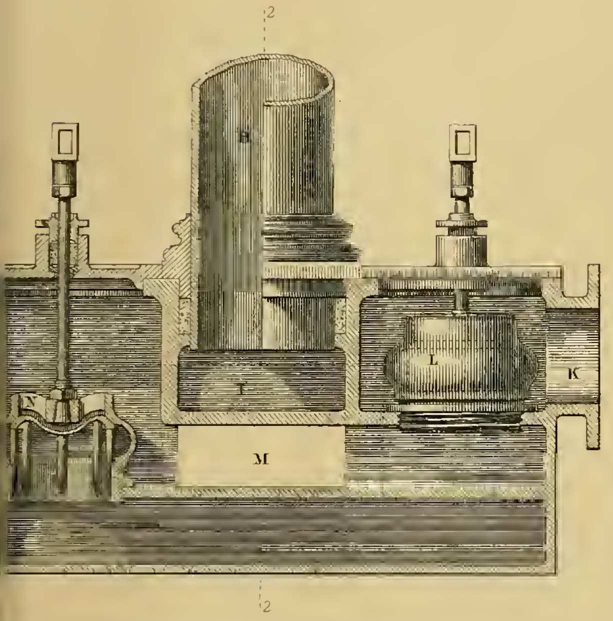


Fig. 5.

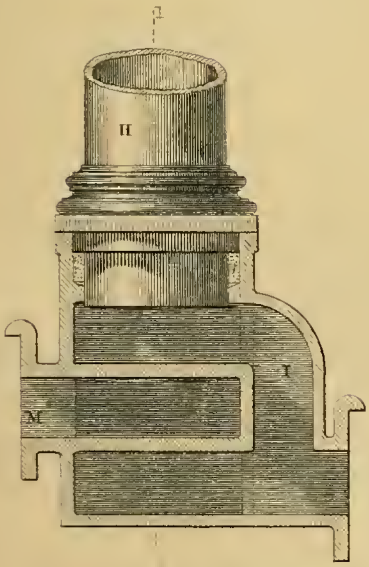
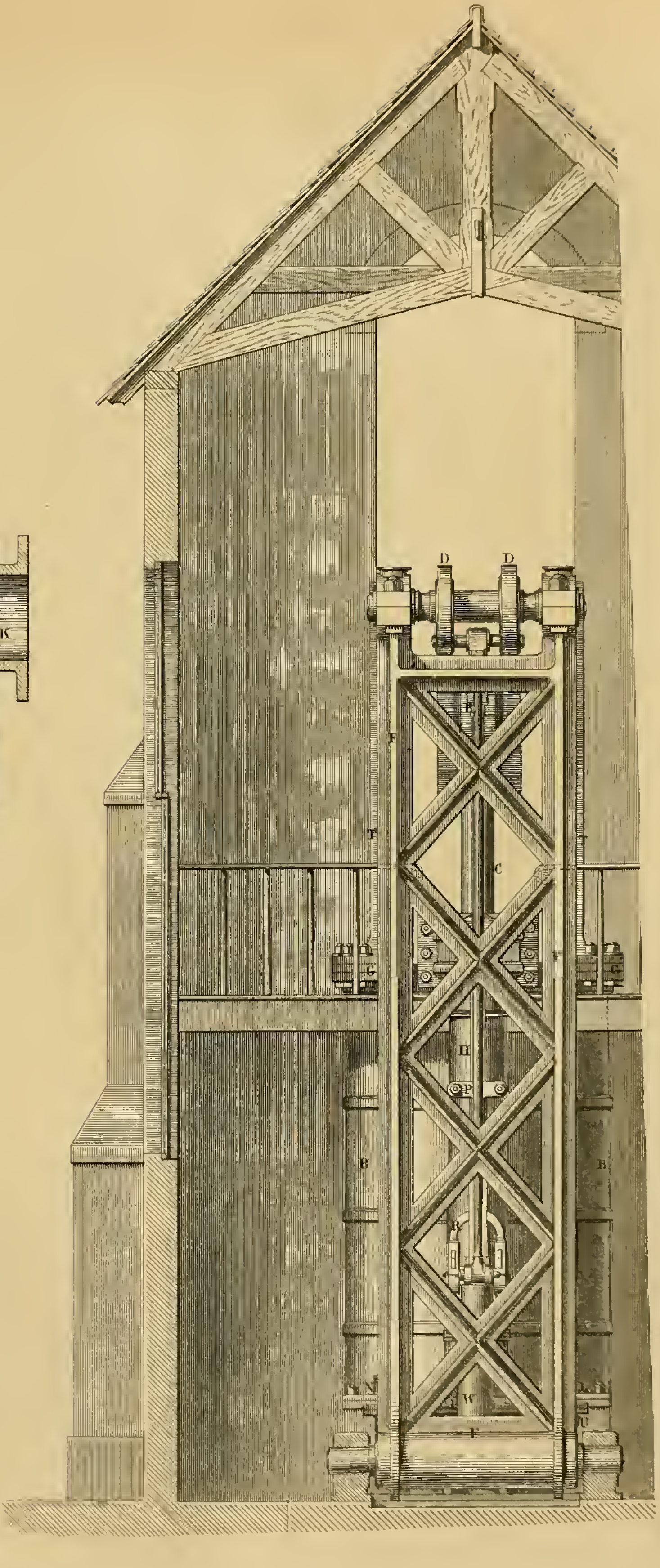


Fig. 2.



PUMPING ENGINE,

BY ANDREW BARCLAY, *ENGINEER*, KILMARNOCK,
PATENTEE.

Fig. 1.

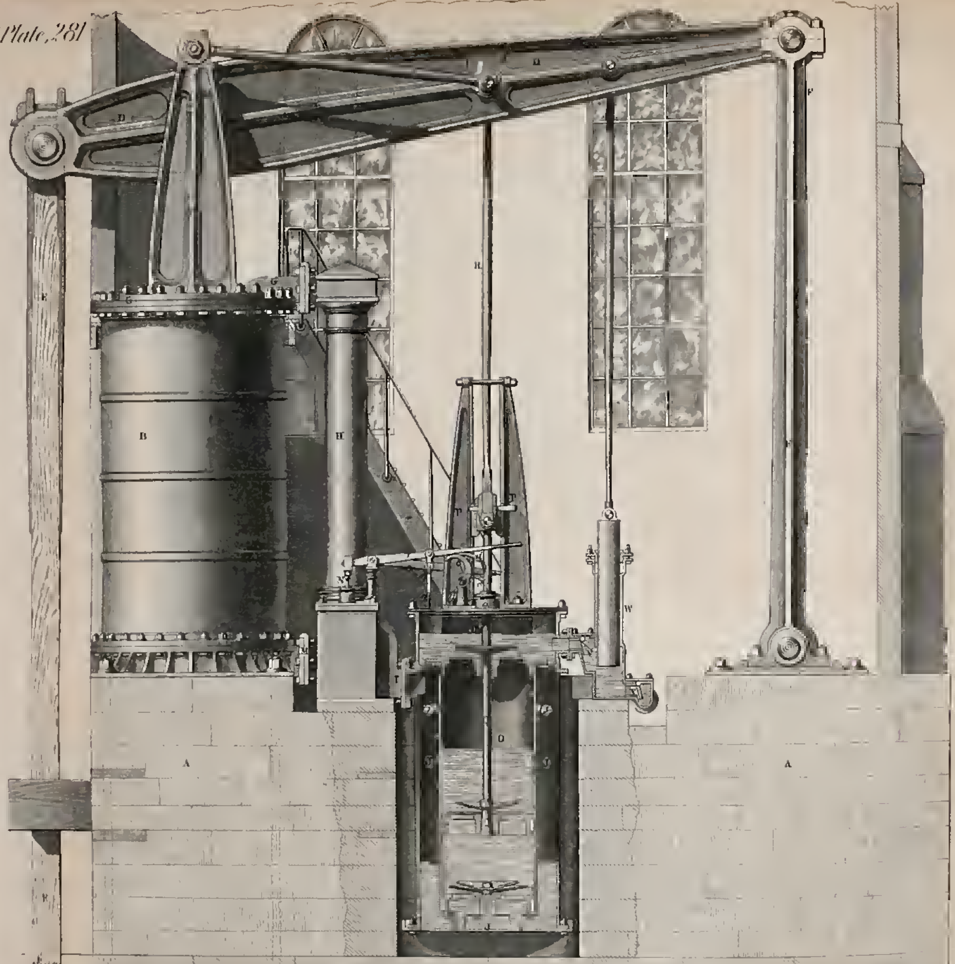


Fig. 3.

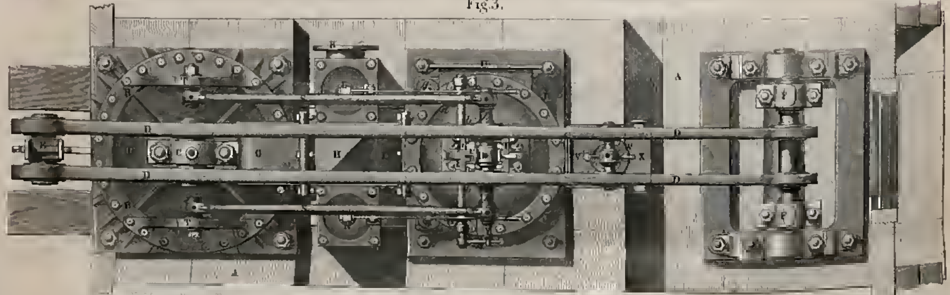


Fig. 4.

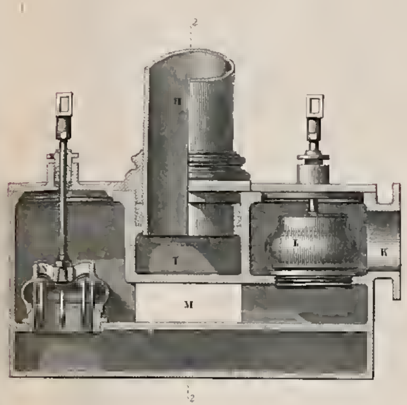


Fig. 5.

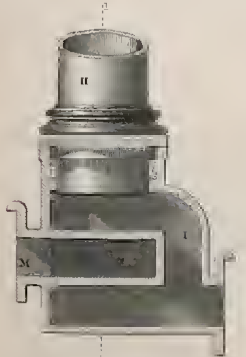
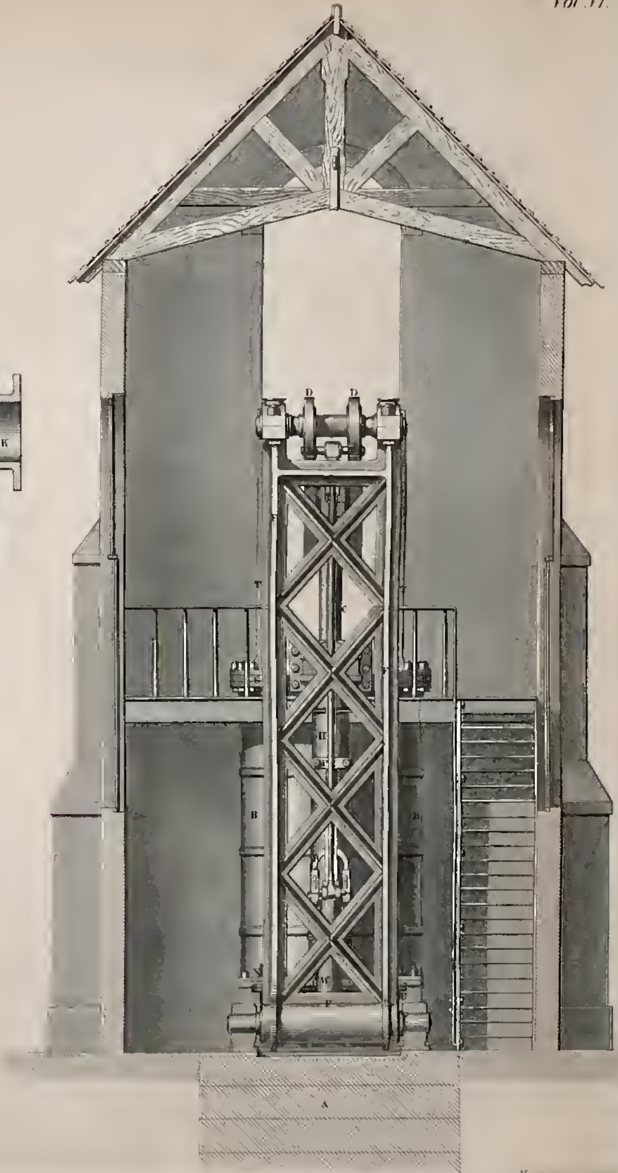


Fig. 2.



For experiments on the effects of compression upon material, the hydraulic press has proved of great service; and there is no doubt but that its more frequent use in the laboratory and in the workshop, for experimental purposes of various natures, would be productive of good to science and to constructive art. We are frequently receiving from foreign countries materials which may cause a revolution in branches of industry if their qualities were known, and the effect of compression is in many cases an important item in arriving at conclusions to turn them to an account.

Although a goodly number of applications of the hydrostatic press have been noticed, there remain many others. The lifting jack is now a miniature hydraulic press; the tyres are forced upon railway wheels, and the copper shell upon printing rollers, by the hydrostatic press, and it is in constant use by a variety of trades, being employed by dressers and dyers, bookbinders, paper-makers, calico printers, and others.

The hydrostatic pumps, when worked by power, require to have stop and let-off cocks which may be easily and instantaneously reversed, and which shall not get easily out of repair. The one exhibited is considered to combine these advantages, and has been greatly commended for its simplicity and efficiency. The movement of the hand lever for a few inches effects in an instant that which was formerly done by a stop-cock requiring many turns of a screw. Other methods have been adopted for this, such as an arrangement with spur wheels and double and treble-threaded screws; but the lever plan is the simplest and most easily adjusted, and the pumps can be continuously worked. The hydrostatic press, and the pumps and apparatus connected therewith, require very considerable care on the part of the manufacturer, and the class of operatives must be of a superior kind.

The cylinders, the pumps, water passages, and valves, have ordinarily to sustain a pressure of 3 tons on the square inch, and in the case of the Indian cotton press pumps, the pressure has been as much as 6 tons on the square inch The joints and working parts must be fitted up with the greatest possible accuracy, and the materials must be of the best quality.

The great improvement which has taken place in the manufacture of wrought-iron pipes has allowed the introduction of pipes of a longer bore than formerly—a condition which is absolutely indispensable for pumps worked by steam power. Fifteen years ago the connection pipes between the hand pumps and the press were made of copper, the bore being only about ¼ to ⅜ of an inch Now pipes of ¾ inch bore are used for the power pumps, and the requsite speed is obtained.

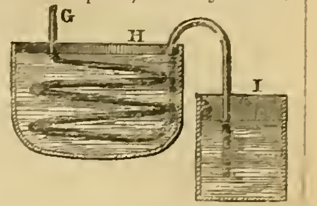
In conclusion, the author remarked, that there were several points connected with the manufacture of the hydrostatic press which required the attention of scientific men. For instance, many of these machines are sent abroad to places where facilities of transport are not to be had. In these the parts have to be made as light as possible, and it would be well if Mr Bessemer and others would endeavour to discover some strong, light, cheap, and easily workable mixture of metals which would supersede cast-iron for cylinders, rams, and tops and bottoms of hydraulic presses.

STEAM AND ITS ECONOMY.

XI.

Many improvements have been proposed to carry out the economy of the marine engine. They may be stated as follows:—First, an improved construction of the steam boiler; and there cannot be a doubt that, in this department, much has been done. Second, many other inventors have been equally industrious in raising the pressures, and contending for superheating the steam and high expansion; a third party maintain that, by a combination of cylinders, the desired economy may be gained; and, a fourth, that the only true path to economy is by a recondensation of the vapour and surface condensation.

We think there can be no doubt that there is much to be gained from what is advanced by each; but when we begin to reason on pressure and expansion, it is absolutely necessary that we keep clearly in view fundamental principles, and take care that our reasoning does not extend beyond these limits. It has been said that I have made statements regarding extreme pressures which cannot be substantiated. What I have written on extreme pressures are not statements but facts, derived from practical experiments and clear deductions from them. We know the effect of heat when applied to water is to produce expansion. The question is, has this expansion no limit? We know that a bar of iron, when heated, expands to a certain extent, beyond this point the expansion ceases, and if the temperature of the metal continues to increase, its molecular arrangement undergoes a change, and the properties of the iron are altered. Further, we know all bodies undergo a change when subjected to intense heat, and it is evident that water is not an exception to this general law; it seems that the expansion of pressure, as applied to vapour or steam, has also a mean point of effective pressure or expansion, and when we exceed this point, economy ceases. It is true, where the pressure is high the steam may be cut off early with advantage, and the remainder of the stroke is said to be performed by the expansion of the steam. From experiment, it seems to be clearly indicated that the expansive energy of the steam in the single cylinder is far short of that amount of energy which we are accustomed to allow for it. It seems also clear that the first impulse of the steam is the great effective power, and if that expansive force again receives immediate momentum it will still exert an effective power; when confined to the single cylinder it is little better than a slowly contracting energy of equilibrium.



The continued condensation of the steam for supplying the boiler with pure water cannot be carried out with economy if the steam or vapour be subjected to intense heat, for we know that any body which is constantly acted upon by intense heat is undergoing a progressive change. In order to verify this, the small boiler referred to in fig. 11, p. 63, was three parts filled with water; there was a tube connected with one of the stop cocks, and when the boiler indicated a pressure of from 15 to 20 lbs. the stop cock connected with the tube was opened, and the vapour condensed in a separate vessel. The large water thermometer, also mentioned in a former article, was filled with the distilled water, and its expansion compared with that of the water from the stream. The expansion of the distilled water at 210 degs. was 2 degs. short of the other. The boiler was then supplied with the distilled water, and to maintain a pressure of 20 lbs. it required two degrees more heat than the water from the stream; this was after repeated boiling, evaporating, and condensing. To carry out this experiment further, I procured an iron worm and a boiler similar to the annexed engraving. The worm was connected with the tube G, of the boiler, the body of the worm resting in the semi-circular boiler, H, which was filled with linseed oil; the oil was heated to indicate a temperature of from 480 degs. to 500 degs., the pressure on the boiler was from 45 lbs. to 50 lbs., the steam was made to pass through the worm so that it might be superheated before being condensed in the vessel, I. The thermometer was again filled with this distilled water, and its expansion, compared with that of water from the stream, was 4 degs. short, thus clearly indicating that the intense heat had, to a certain extent, impaired the natural energies of the water. The steam boiler was again supplied with this water of condensation, and its pressure compared with the steam from the water when first supplied. From the annexed table it will be observed that the difference of energy is considerable. From this it would appear that what we gain by using distilled water, we lose, to a considerable extent, in fuel, in order to raise the energy of the steam to its effective pressure.

Stream water.	Condensed water.
10	9
15	13
20	17
25	21
30	25

From this it seems to be a question as to the amount of economy gained when compared with the water from the stream; as the distilled water is from three to four degrees lower, it indicates that the intense heat, to a certain extent, impairs the natural energies of the steam as well as the water. The steam boiler was again supplied with distilled water, which had been subjected to the freezing temperature—the water passing into the solid or crystalline state—indicated clearly that it had gained its original elastic energy.

From these experiments it is quite apparent that water or steam, which has been overheated, loses a certain amount of its elastic force, and that elastic force seems to be regained by the water again passing into the solid or crystalline state. If boilers are to be supplied by water obtained by a continuous condensation of the steam, then the water or steam should never be subjected to intense heat. These observations bring us back to those principles or laws that we are generally conversant with, *i.e.*, that intense heat changes or destroys the natural properties of matter, which must again undergo a change before it can regain and give forth its natural energy.

Paul Cameron.

SWING COT FOR SEA VOYAGES.

Some little time back Sir John Herschell submitted for the consideration of the Society of Arts, the following mode of suspending a cot on shipboard where a whole cabin is disposable as a sleeping apartment (the cot being removable in the day time), as having, from experience in a voyage to the Cape and back, found it productive of a degree of comfort far surpassing any of the ordinary arrangements of swing cots or beds on jimbals which he had seen adopted; affording an invalid, in the roughest weather, the most complete immunity from all the ordinary causes of complaint arising from the pitching and rolling of the vessel, and entirely obviating any tendency to sea-sickness. Its principle is the reverse of free or jimbal suspension, and relies on friction as a means of deadening oscillation. As the figures annexed will speak for themselves, no lengthened description will be needed; and as regards expense, it may be fitted up by any ordinary carpenter and black-smith at the cost of a very few shillings.

Fig. 1

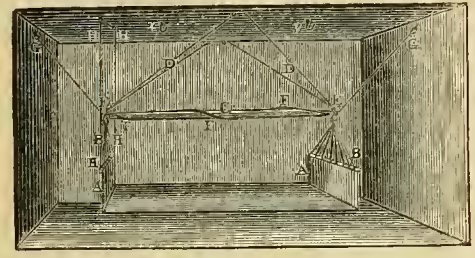


Fig 1 is the interior view of a cabin with the cot A, suspended by the clews, B, from the hooks, at the end of the cot-pole, C, which is itself suspended by cords or light iron rods, D, of precisely equal lengths (when equally stretched), and which (if cords) are firmly knotted, so as not to run, to the rings, E, on the upper side of the pole, and are furnished with hooks at their upper ends, attachable when in use to rings screwed on the starboard and larboard side of its medial line, or right athwart ship, into the ceiling of the cabin, the planes of which should be adjusted fore and aft. The cot-pole should lie exactly horizontal, and truly fore and aft when the ship is at rest, and the lengths of the cords or rods, D, should be adjusted accordingly.

F, is a friction band (cord is better than woollen list, which creates too much friction), attached by loops, G, to the fore and aft walls of the cabin, and passing into, through, and round the cot-pole C, in the manner represented in fig. 2 and fig. 3, the first being an elevation, and the latter a longitudinal section, of one end of the cot-pole, showing the channel through which the friction-band enters and emerges at either end. It is needless to remark that all this part of the work must be smoothly rounded to avoid cutting the band.

Fig. 2.

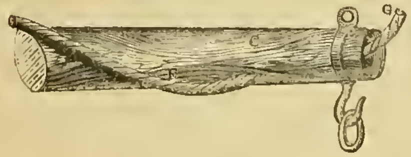
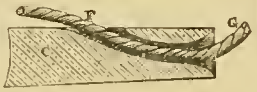


Fig. 3.



A stout packing-thread H, is attached to the cot at the foot, and passed through rings screwed into the ceiling; the pack-thread being so tightened by trial as to destroy, by its friction on the rings, the effect of the ship's roll, as the friction-band, FG, effectually does that of its pitch.

The figures are on no precise scale, which must depend on the dimensions of the cabin The cot should hang about a foot from the floor, and the height of the pole should be adjusted accordingly. But every part here figured is essential to the well-working of the concern, and ought on no account to be departed from by the workmen employed to construct it.

In the day time, the cot may be removed, and stowed away as usual, and the cot-pole put out of the way on the hooks *x*, *y*, under the ceiling, with the line rolled round it. When the bands wear they are easily replaced by new ones.

He recommended the principle here employed (the quieting of oscillations by friction, in lieu of perpetuating them by the usual modes of free suspension) with proper adaptation to the special case, for hanging ships' barometers; for suspending a chair for telescopic observation at sea (for which a stiff rope or end of cable *fixedly* attached at the upper end might be worth trying); for swing trays, lamps, &c., on shipboard.

[Sir John Herschell mentioned to us in conversation several years ago, that he himself had derived this method of "cot" swinging while on board on his voyage to the Cape of Good Hope (to observe the Southern stars), and had derived great personal comfort from it. The Gyroscope has, however, since presented the means for still further improvement—Professor Smyth's success in fixing a telescope on board a rolling ship shows that a sleeping berth might also readily be made to preserve constantly the horizontal plane.—Ed. *P. M. J.*]

PUMPING ENGINE.

By Mr Andrew Barclay, *Caledonian Foundry*, *Kilmarnock*, Engineer.

Illustrated by Plate 281.

The plate accompanying the present number of the *Journal* represents Mr Barclay's most recent arrangement of an engine suitable for mining purposes. In this modification the object of the designer has been to keep the mouth of the shaft perfectly clear of the engine, in order to afford ready access to the pump rods and other gear. To accomplish this Mr Barclay has adopted a particular arrangement of the "grasshopper," or rocking beam engine, the cylinder being kept clear of the mouth of the shaft, and the end of the beam over-hanging the shaft sufficiently to attach the pump rods directly thereto. Fig. 1, on plate 281, is an elevation partially in section of the engine shown as arranged immediately at the side of pit shaft. Fig. 2 is an end elevation looking upon the vertical rocking shaft or open lattice frame to which the inner extremity of the beam is connected, and fig. 3 is a plan corresponding to fig. 1. Fig. 4, is a vertical section of the valve chest, showing the steam valve in elevation, and the exhaust valve in section, taken on the line 1, fig. 5. Fig. 5, is a partially sectional elevation of the valve chest, taken at right angles to fig. 4 on the line 2, of that figure.

The engine is arranged close to the side of the shaft upon a foundation or substructure of masonry, A, on the outer edge of which the cylinder, B, is fixed. The upper end of the piston rod, C, is connected to the duplex beam, D, at a point about one fifth of its length from the outer extremity which overhangs to a small extent the face of the masonry, A. To this overhanging part is attached the pump rod, E, which descends directly down the shaft. The inner end of the beam, D, is supported by the upper end of the vertical shaft, or open lattice frame, F, which is carried in bearings bolted to the masonry, A, and rocks to and fro in accordance with the reciprocatory motion of the beam. The cylinder cover, G, has cast in it a laterally branching tubular passage which opens into the column, H; this column is arranged in a vertical position parallel to the cylinder. The column, H, is open throughout its length, and it communicates at the lower part with the exhaust passage, I, leading to the condenser, J. This exhaust passage, I, extends across the valve chest the full width of the cylinder, B, and on the further side of it is fitted the valve, L, for admission of the steam to the lower side of the piston. A longitudinal section of this portion of the engine is shown in fig. 4, in which the relative positions of the steam and exhaust valves are clearly shown. The steam passes from the steam pipe, K, and through the valvular opening which is controlled by the valve, L, to the steam passage, M, communicating by the steam port with the lower part of the cylinder, B. After the steam has exerted its pressure on the piston, the valve, N, is opened to the passage, I, and the steam flows through the valvular opening down to the condenser, J, in which the air pump, O, is arranged. On the hot well cover are fitted two standards, P, which, form a guide for the upper end of the air pump bucket rod, Q; the extremity of this rod has jointed and keyed to it the connecting rod, R. The upper end of this rod works on a cross head, Z, passing through the duplex beam, D, the cross head has keyed to its projecting extremities the radius rods, S, which are centred on the upper ends of the standards, T, bolted down to the cylinder cover, G. The water of condensation which is raised by the air pump bucket to the upper part of the condenser flows partly away by the opening, U, in the hot well, to the cistern or other receptacle, and partly through the valve, V, to the pump, W, by means of which it is forced through the valve, X, to the boiler. The steam and exhaust valves are operated upon by means of the rod, Y, which is attached to the centre, Z, of the beam, D. The rod has two laterally projecting studs, which alternately actuate the lever, *a*, as the rod rises and descends in accordance with the motion of the beam. The lever, *a*, is fast to the rocking shaft, *b*, which is carried in bearings bolted to the cover of the hot well. This rocking shaft has keyed to it two cams or curved arms, *c*, which are arranged so as to lift the hand levers, *e* and *f*, alternately. These two levers, *e* and *f*, are respectively connected to the spindles of the steam valve, L, and the exhaust valve, N. Each lever is also connected by a rod, *g*, to the plunger of the cataract. On the rocking shaft, *b*, are also fitted loosely two bent arms, *d*, the lower extremities of which are furnished with counterweights, which have a tendency to bring the bent arms under a laterally projecting stud on the levers, *e* and *f*, and so keep the valve down during the completion of the stroke. With this arrangement of the engine, the mouth of the shaft is kept entirely clear and free from any overhanging portion of the engine, and in this way the pump rods are entirely free from any obstruction whatever, which admits of their being connected and disconnected in the readiest manner possible, as well as being at all times accessible. Mr Barclay has erected an engine of this kind at the Greenfield Colliery, near Hamilton. The diameter of the cylinder is seventy-two inches, the length of the stroke is twelve feet, and the engine is working a twenty-seven inch plunger pump. Another mode of arranging these engines, is to place the cylinder above the beam and quite clear of the mouth of the shaft. The beam in this case is arranged in a recess or cavity which is formed for the purpose in the masonry of the foundation. One extremity of the beam projects over the shaft, and to this overhanging portion the pump rods are attached. The arrangement of the other working parts of the engine does not essentially vary from that shown in the illustrative plate. This mode of arranging the engine may be varied by placing the cylinder at one side of the shaft, and causing the beam to extend across it, one extremity of the beam being supported by a rocking shaft, whilst the opposite end is connected to the piston rod, the pump rods being connected to that portion of the beam which extends across the shaft. In engines of large size where the beam is of considerable weight, it is preferred to support it upon a pillar of masonry, and arrange the cylinder between the pillar and the edge of the pit. A small portion of the beam is allowed to overhang the mouth of the shaft, and to this part the pump rods are attached. If required a second set of pump rods are attached to the free extremity of the beam, and are carried down a secondary shaft; this arrangement is useful where it may be found advantageous to raise the water from different levels in the mine. Or the beam may be a comparatively short one, its extremity working in a pedestal bearing arranged on the pillar or wall, the pump rods being connected to the outer end of the beam which overhangs the mouth of the pit just sufficient to keep the rods clear. The piston rod and the air pump bucket rod are connected to the beam at convenient points between the pump rods and the main centre of motion of the beam, the parallelism of the piston and air pump rods being maintained by means of radius rods. These several arrangements are equally applicable to double acting engines as well as to those of the single acting class.

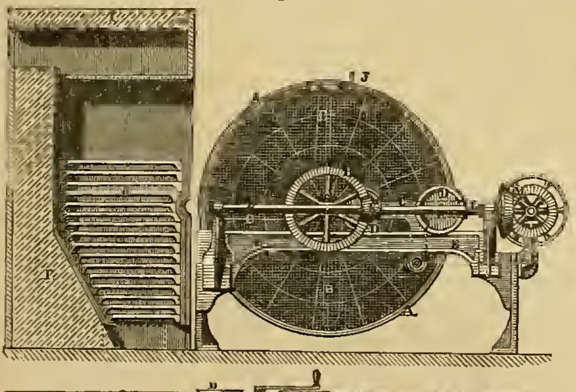
RECENT PATENTS.

MACHINERY FOR DRYING GRAIN AND MALT.

Thomas Barnett, *Beverley, Yorkshire.—Patent dated Oct.* 10, 1860.

This invention has for its object the drying of corn, roots, and seeds, and especially of Egyptian or other wheat, which has been previously subjected to the process of washing, and for roasting coffee, cocoa, chicory, malt, and other vegetable substances (herein-after called "the substances"), by exposing them on a thin layer and in a state of motion to the action of radiated heat, thereby effecting a more speedy evaporation of the moisture contained in them, and saving time and expense in such drying and roasting. The invention consists essentially of a combination of parts forming an apparatus for effecting the above-mentioned object, and is fully illustrated by the subjoined engravings, fig. 1. of which is a side elevation of the machine, showing the drum with its movable frame or carriage drawn back out of the furnace, and shown in vertical section; and fig. 2. is a plan of the same, the furnace being shown in horizontal section, and the drum within it. The substances to be operated upon are placed in the revolving drum or cylindrical receiver A, by a door on its rim or edge shown at J; this drum is formed of iron or other metal, which is sufficiently durable, and its periphery consists of a metallic plate or flange, to the sides or edges of which all around are attached pieces of wire cloth or perforated plates forming the ends of the drum. The breadth of the drum is much less than its diameter, so that a layer of the substances between the two ends of it may be thin and easily penetrated by the heat applied at the ends. It is preferred that the breadth of the drum at its periphery and between the ends should not exceed about one-sixth or seventh of its diameter. The length or breadth of the drum (which somewhat resembles a circular grind-stone in shape), between its ends should gradually diminish from the centre towards the circumference, so that the ends form two obtuse cones; the length or breadth at the centre being equal to twice the length or breadth at the circumference, in order to prevent the substances placed within the drum becoming wedged or fixed around the interior near the circumference. In the interior of the drum, and against the wire cloth or perforated ends of this drum, arms or projecting vanes, B, are fixed, extending from the interior of the drum at its periphery to the axle; one half of the number of these arms is fixed across the semi-diameter of the drum at one end, and the other half of the number across the semi-diameter at the opposite end, alternating with each other, so as to act alternately upon the substances within the drum as it revolves. Two or more of these arms being placed at each end of the cylinder, the wire cloth or perforated metal, forming the ends of the drum and also the arms, above mentioned, are secured by bolts or otherwise to an axle upon and with which the drum revolves. An opening, closed by a slide or door at J, is left in the circumference of the drum for the admission of the substances to be operated upon, and for their discharge after they have undergone the process of drying or roasting. The drum is filled through this door by means of a hopper, spout, or other similar arrangement placed above it, and when the substances have been operated upon they are discharged at the bottom of the apparatus through the same door or opening. The axle of the drum extends to such length as may be required to mount the drum in bearings fixed in a frame, C, within which the drum revolves, and rotary motion is communicated to the drum through the medium of its axle by manual or other power when substances are placed within it in order to be operated upon. The frame, C, which carries the drum consists of two sides and an end, the bearings of the axle being fixed at or near to the ends of the side arms at the open end of the frame, so that one half of the drum, or nearly so, may project beyond the open end of the frame. The sides are securely fixed by bolts to the end of the frame. This frame within which the drum is mounted is made moveable, so that that part of the drum which projects beyond the frame may be introduced into an opening in a furnace or between two fires, F, in order to dry or roast the substances placed in the drum. It is preferred that the frame, C, should have attached to its under side four or more flanged wheels, D, which support it and traverse along two fixed rails, E, as shown in the engravings. These rails, E, may be supported by pillars or standards at each end, or attached to the brickwork, I, of the furnace, F. In the modification shown they are shown as supported by pillars or standards. The rails should extend outwards from the furnace or fires to such a distance as to allow the drum to be withdrawn from the opening in the furnace between the fires, as seen in fig. 1. Instead of moving the frame carrying a drum along rails in this manner, it may, when worked by hand, be suspended in any convenient manner, so that the half or some part of the drum shall be capable of being brought within and withdrawn from the opening in the furnace between the fires. The furnace contains two fire-places with their fronts or faces opposite to each other at a sufficient distance from each other to allow the half or some other portion of the drum to be introduced between them. The fronts or faces of the fire-places are placed at the same angles to each other as the sloping ends or sides of the drum, so as to be parallel with the ends or sides of the semi-diameter of the drum when introduced between the fire-places, and the front of each fire-place is of the same length as the semi-diameter of the drum, and fitted with a vertical grate placed at the same angles as the sides or ends of the drum, and placed so as to be from a quarter of an inch to an inch distant from its respective ends or sides when introduced between the fires, as shown in the horizontal sections of the furnace, fig. 2. Rotary motion is given to the drum through the axle, G, by any convenient mechanical power. In the arrangement shown, rotary motion is given to the axle, G, of the drum, A, by the wheel, H, keyed to it and kept in gear with the pinion, K, by a bracket encompassing the box of the latter; thus causing the pinion, K, to traverse along the longitudinal shaped shaft, L, along with the carriage frame, C. The shaft, L, deriving motion from the first motion or short transverse shaft with a fast and loose strap pulley threw the pair of miter wheels, M. The heat from the two fire-places will be radiated through the wire gauze into the drum, and dry or roast the substances within the drum. The drum should not be completely filled with the substances to be dried or roasted, but rather more than half filled. The velocity and time occupied in drying or roasting the sub-

Fig. 1.



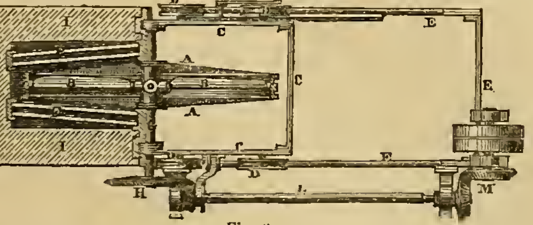


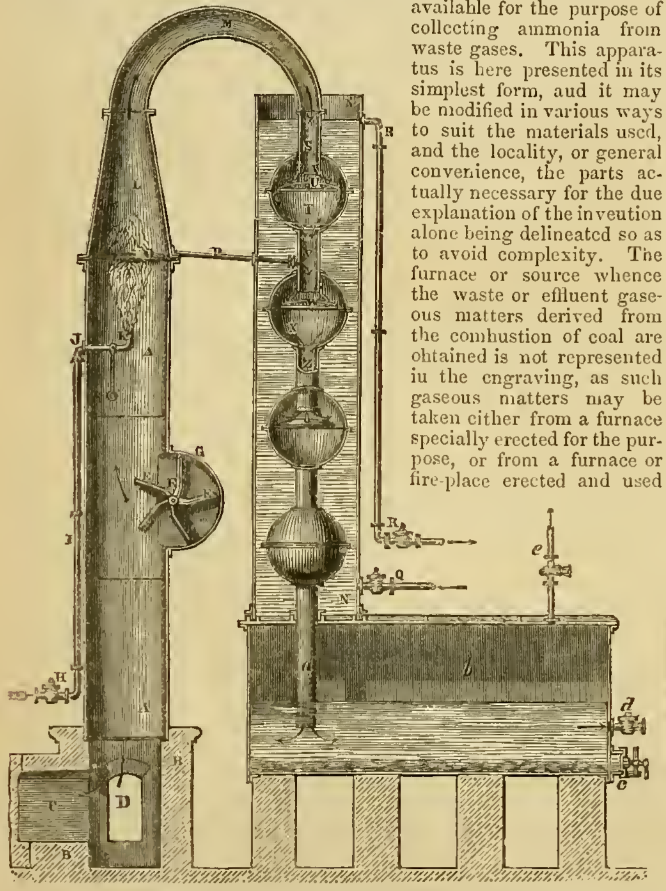
Fig. 2.

stances operated upon, the patentee finds to be from forty to fifty revolutions per minute, but the speed at which the drum should revolve, in order to be most effective, will vary with the density and dampness of such substances, and the greater the density of the substances the greater should be the speed of rotation.

TREATING WASTE GASES.

J. A. Manning, *London.—Patent dated May* 3, 1861.

Mr Manning's present invention relates to a mode of collecting and obtaining ammonia from what have been hitherto waste gases arising from the combustion of coal in the manufacture of coke, and from the combustion of fuel in factories, foundries, and in other situations or processes wherein coal is largely consumed, and it consists in vapourizing the effluent or escaping gases as they leave the furnace and ascend the main chimney or shaft, by the introduction therein, or the admixture therewith, of a jet or jets of steam. This steam, after it has become charged with the ammoniacal and other gases with which it combines, or becomes impregnated, is condensed by passing it through, or into, suitable condensers or refrigerators, so that an ammoniacal liquid may be obtained from which sulphate of ammonia may be manufactured by the ordinary or any other suitable process for preparing that salt.



The subjoined engraving is a complete sectional elevation of one modification or form of the apparatus which is found to be advantageously available for the purpose of collecting ammonia from waste gases. This apparatus is here presented in its simplest form, and it may be modified in various ways to suit the materials used, and the locality, or general convenience, the parts actually necessary for the due explanation of the invention alone being delineated so as to avoid complexity. The furnace or source whence the waste or effluent gaseous matters derived from the combustion of coal are obtained is not represented in the engraving, as such gaseous matters may be taken either from a furnace specially erected for the purpose, or from a furnace or fire-place erected and used for other purposes than the mere generation of the matters to be utilized in accordance with the scheme of the present invention. A cylindrical wrought-iron chimney shaft, or flue, A, is erected vertically upon a brick-work base, B. This brick-work forms a base chamber for the primary reception of the gaseous matters which arrive by the horizontal ducts, C D. From this receiving chamber the gaseous matters ascend the shaft or chimney, A, an artificial draught being created when necessary by the revolution of the fan, E, carried upon a short horizontal spindle, on which is a driving belt pulley, F. This fan is contained within an external case, G, carried by the chimney, and its vanes project to about the vertical central line of the chimney, so that when driven at a high rate of speed, in the direction of the winged arrow, an upward current is produced within the chimney, and this artificially produced draught is particularly useful when the fires are first lighted, although in actual practice it has been found that it can occasionally be dispensed with, using merely a steam blast or jet. The steam is brought from a boiler or other steam reservoir by the pipe, H, on which is a stop-cock or valve. The steam passes through the valve up the vertical pipe, I, which pipe enters by a bend at J, into the upper part of the chimney, A, and terminates in a blast or jet piece at K. This steam jet produces a powerful draught in the chimney, and the ascending smoke or gaseous matter at once commingles with the steam, and the entire gaseous product is at once carried in the form of vapour up into the conical top, L, of the chimney, and thence by the surrounding bend, M, to the condensers contained in the large vertical refrigerating tube or vessel, N. An annular trough or gutter, O, is fitted in the interior of the chimney, A, for the purpose of catching any liquid of condensation which may trickle down the sides of the conical head, L, of the chimney, A. Whatever fluid is detained here is at once conveyed by the pipe, P, to one of the condensers in the vessel, N. The vessel, N, is kept fully supplied with water by the bottom horizontal pipe, Q, furnished with a regulating stop-cock, and the discharge of the used water takes place by the vertical pipe, R, the heated or spent water being passed off to a receiver at the lower end. The surmounting bend, M, leading from the chimney, A, terminates at S, in the upper spherical condensing chamber, T, of the series in the vessel, N. The portion, S, of the bend, M, is passed for a considerable distance into the interior of this upper spherical condensing chamber, T, and it has suspended from it, by small bracket holders, a convex disc, U, to act as a spreader or diffuser of the passing vapour and gaseous matters. In this upper sphere, T, the passing current is partially condensed or reduced in temperature, and the current passes onwards by the pipe, V, which is fitted like the portion, S, of the bend, M, with a suspended convex disc, W, set in the interior of the second sphere, X. There the diffusion and condensation go on still further, and another connecting pipe, Z, conducts the current still further downwards to a third diffusing disc in the interior of the third sphere. The fourth connecting pipe again conveys the products to the bottom condensing sphere, which is formed and fitted in every way in the same manner as the other spheres. The condensing details may obviously be of various shapes, and variously arranged, both as to series and number. The terminal pipe, *a*, is entered by a stuffing-box through the top of the tank or receiving reservoir, *b*, supported upon a brick-work or masonry foundation. In this way the steam, charged with the ammoniacal, and other gases arising from the combustion of the coal, is condensed, and the ammoniacal liquid is deposited in the tank, *b*, for after treatment according to the ordinary or other manner of obtaining sulphate of ammonia from ammoniacal liquor. A door, *c*, is fitted in the end of the tank for the purpose of obtaining easy removal of the flocculent, sooty, carbonaceous, or other solid deposit arising in the process. The pipe, *d*, governed by a stop-cock, is fitted upon the tank, for the conveyance therefrom of the ammoniacal liquor, as represented in the engraving, to the still or other apparatus employed in the conversion of the liquor into sulphate of ammonia. The pipe, *e*, on the top of the tank, *b*, is for the conveyance of the carburetted hydrogen and other gaseous bodies, apart from the ammoniacal liquor, for separate treatment and use as may be deemed advisable.

In this process the whole of the gaseous matters arising from the combustion of the first are utilised to the utmost extent, as the whole apparatus is closed and virtually sealed up.

It will be obvious to the practical man that the hereinbefore described improvements may be judiciously adopted for the abatement of the smoke nuisance in most situations where such nuisance exists. The smoke evolved from the chimneys or shafts of factories, foundries, coke ovens, and generally from all smoke outlets, may thus be condensed and prevented from escaping into the atmosphere, and tall chimneys will then in most cases be unnecessary. In steam-ships the smoke may be taken off, and prevented from escaping as at present, by at once taking the smoke into the apparatus from the "up-take" of the boiler flues.

MOTIVE POWER.

J. H. Johnson, (Auguste Prouvost *Paris.*)—*Patent dated Jan.* 26, 1861.

This invention comprehends various improvements for the obtainment of motive power, from the expansion and compression of air, gas, or vapour, and in the machinery or apparatus employed therein.

The object of the invention being the economical use of calorie as a motive power by such compression and the expansion of air, gas, and steam, or vapour, and particularly by their regeneration after producing their dynamic effect.

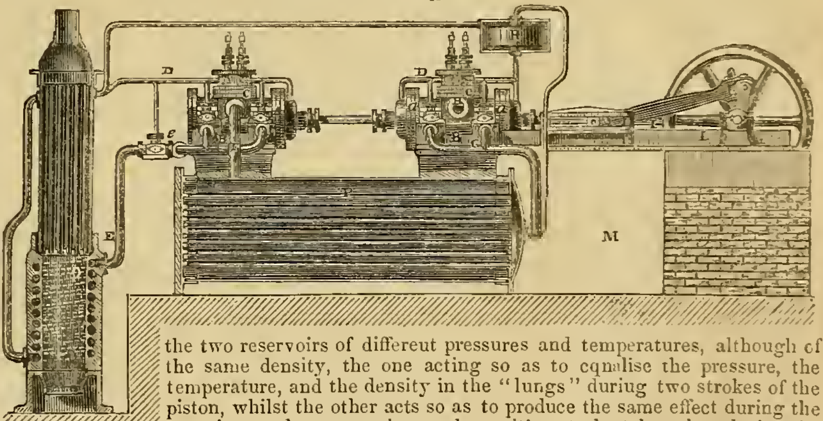
This regeneration, which constitutes the essential feature of this invention, is based on the possibility of maintaining an uniform density under different degrees of pressure and temperature, and of restoring the density to its former state after expansion with very little loss of force, by concentrating as well as by dispersing the caloric, whereby the caloric may be employed several times, or with very great economy;

also of advantageously employing air or gases, which are compressed previously to heating them. This is effected 1st, by restoring the molecules to their normal density after expansion, so as to utilise them indefinitely, which is effected by compression and counter pressure. 2d, by transmitting to a new agent the caloric which has developed a mechanical force, so as to utilise it anew.

One of the distinguishing features of this invention is, the addition to the motive or working cylinder of supplemental capacities or chambers, which the inventor calls "lungs," and which, in the existing machines, would be considered useless spaces, and the addition also of pressure and counter pressure apparatus, so as to act only by reaction, compression in this case being equivalent to condensation in vacuo. The apparatus for producing pressure and counter pressure in the double pyromotor, consists of a superheating generating apparatus, a saturating regenerating apparatus, and a refrigerating apparatus, all of which are as essential to the working of the machine as are the "lungs," as will be hereafter explained.

Several of these improvements may be applied to other hot-air engines by using other means and apparatus; and to illustrate this, the patentee classifies them under two heads, namely, reaction engines and circulating engines, each of these again containing two distinct divisions, namely, the engines which concentrate the caloric after it has been subsidiarily used, and the engines which disperse the caloric.

Fig. 1.



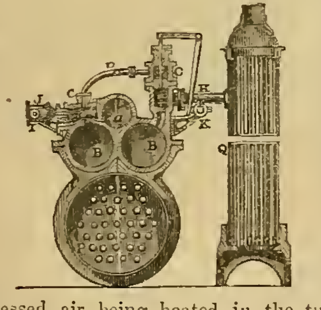
The accompanying engravings and description illustrate one modification of these different types, and the improvements which may be made in them by combining the double reaction engine, which concentrates and disperses the caloric, and in which are summed up and included all the said improvements.

This first modification shows the pyromotor or double engine complete with its details, worked both by air and steam, which regenerates the caloric and the molecules in order to increase the transmission of mechanical power.

Fig. 1 represents a longitudinal side elevation; fig. 2 represents on the one side a half transverse section of the cylinder, the "lungs," and the saturator, taken through the axis of the slide valves, and on the other side is represented a similar section taken off the axis of the valves; and fig. 3 represents a mode of working the pyromotor in order to facilitate the proper understanding of the same.

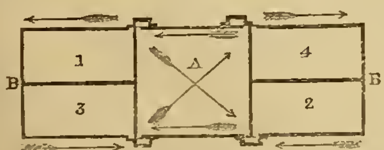
These figs illustrate the different apparatus and elements composing the double pyromotor, namely, the superheating generator, O, which superheats the steam in a serpentine or coil of pipe surrounded with cast-iron which serves as the furnace, and which is surmounted with a vertical tubular chamber which serves as a generator, and through which pass the flames from the furnace on their way out to the chimney to the top of the tubular chamber. This mode of construction enables the machine to generate steam more or less expanded, although more or less superheated by graduating by means of a varying water level the surfaces of vaporisation.

Fig. 2.



The saturator, P, which acts at the same time as a regenerator, is composed of a cylindrical tubular body covered at one end by a cap which affords communication to the series of pipes which are closed at the opposite end. After the steam has expended, it is forced back into this cylindrical chamber, where it is saturated, and where the caloric is concentrated, the compressed air being heated in the tubes by depriving the steam of its caloric in order to exert its expansive force in the air cylinder, *a*.

Fig. 3.



The refrigerators or cooling apparatus, Q, one of which is shown shortened and broken in the centre in fig. 2, is surmounted with a chimney, and is also formed of tubes open at both ends, through which the atmospheric air passes, and carries off and disperses the caloric of the compressed air contained in the interior of the case, to serve as the counter pressure of the same air cylinder, *a*.

It will also be seen that the working cylinders, A, and *a*, a diagram of which is represented at fig. 3, are furnished with four "lungs," B, as is actually the case, but these "lungs" are differently arranged in the engine, as may be easily perceived from fig. 2, in fact they are separated by a transverse partition, whereas in fig. 3 they are shown to be separated by a longitudinal partition, and are numbered in order that the working may be more readily understood.

Before explaining this it must be borne in mind that each "lung" for two strokes of the piston ought to communicate with the superheating apparatus, O, in order that the density of the pressure and the temperature of the "lung," and the superheating apparatus may be equalised, and for two other strokes of the piston it should communicate with the working cylinder in order to aid expansion and compression according as the stroke is positive or negative, and that this is effected by means of the four slide valves, actuated by the eccentrics, J, alternately opening and shutting the orifices of the superheating apparatus, and of the cylinder so as to place them in communication with it. The four equilibrium valves actuated by cams, K, serve each in its turn to put the cylinder in communication with the saturator during the time compression or the negative stroke takes place. This is effected in the following manner:—

The "lung" No. 1 is used for expansion, whilst No. 4 is used for compression, then No. 2 is used with No. 1, No. 3 with No. 2, and No. 4 with No 3, and so on, all the movements of the arrangement crossing each other in the direction shown by the arrows.

It will thus be seen that the "lungs," B, are used for the purpose of effecting repercussive reactions at each stroke of the piston by means of the two reservoirs of different pressures and temperatures, although of the same density, the one acting so as to equalise the pressure, the temperature, and the density in the "lungs" during two strokes of the piston, whilst the other acts so as to produce the same effect during the negative stroke; expansion or the positive stroke takes place during the opening of the orifice, which places the "lungs" in communication with the cylinder, whilst the negative stroke takes place only when the orifice is shut.

Moreover, as gases are not governed by the same physical laws as steam, it is proposed, as regards air and gas, to compress them by mechanical means previous to heating them, in order to obtain a greater difference of tension at the same temperature, and with the same quantity of caloric, for it is evident that by so doing, an incontestible advantage will be derived in a practical and economical point of view. As regards steam, since it cannot be cooled completely without losing a great part of its latent heat, and since its density varies under different pressures and at different temperatures, unless it be superheated and saturated, it is proposed, as a general principle under this invention, to superheat and gasefy the steam in order to increase its tension to a certain density by causing it to expand so as to produce the dynamic effect, and afterwards to saturate it in order to restore it to its normal density in utilising the entire difference of tension and of temperature which exists between a saturated and gasified vapour or steam of the same density; it will be advantageous also to concentrate their caloric after expansion, as it will always be easy to utilise the surplus caloric either for increasing the motive power, as is effected by the double pyromotor, or for utilising it in any other chemical or industrial operation, hereafter referred to. After what has been said, a simple enumeration and description of the several parts by letters of reference will suffice to explain this motive power engine in these several figures.

A is the working cylinder, B the "lungs," ("poumons"), C the chest containing the slide valves and stuffing-box, D the connecting pipes, E the superheating steam pipes, *c* the starting valve, F the conducting pipes leading from the "lungs" to the saturator, G the hot-air pipes, H the pipes from the "lungs" to the refrigerators, Q; I, J, K, the shafts, eccentrics, and cams respectively, which actuate the slides and lifting valves. Two eccentrics, keyed on the crank shaft, on each side of the bed plate, L, work the air and water-feeding pumps, not shown in the engraving, but placed in the open space, M It is to be observed that in using superheated steam, the piston and the surfaces of the cylinder are lubricated by the counter pressure of saturated steam, and the surfaces of the slide valves, the stuffing boxes, and their packing, are protected by a chest or envelope, C, filled with saturated steam at the highest degree of pressure, since it comes from the generator, and that when air is employed, the same chests or envelopes are supplied with lubricating liquids which renders them perfectly air-tight, such liquids being supplied from a small reservoir, R, of the same pressure as the generating apparatus, O, and surrounded with a steam jacket to preserve the caloric.

The description of those portions of the machine which are simple, or considered well known, have been here omitted.

The second modification which is described in this specification, is a simple reacting pyromotor worked with regenerated steam, and distils water with the caloric, which it concentrates in its saturator. This saturator or distilling apparatus, which is composed of a system of pipes, and has a cap at each end, in order to afford communication through the whole system of tubes, which are arranged vertically, instead of horizontal, as at P, in fig. 1, and arranged somewhat similar to the vessel *t*, in fig. 4. The water to be distilled entering as it were at the bottom, *a*, and escapes in the form of steam at the top, *b*, in the fig, which communicates with a condenser, in order that the distillation may take place in vacuo, a pump forces the water to be distilled into the saturator, and another pump draws the distilled water from the refrigerator. The rest is identical with that of the double engine herein-before described. The superheating generator in this case is composed of a system of pipes, X, fig. 6, made so as to pass over a furnace, and through its flue lying at an angle so as to produce steam more or less expanded and superheated, graduating the pressure and the temperature by causing the area of the evaporating and the superheating surfaces to vary reciprocally by varying the level of the water in such angular tubes, X.

It differs from the generating superheater described in reference to the first arrangement shown in figs. 1 and 2, inasmuch as it is constructed so as to graduate also the caloric in proportion to the temperature, the combustible gases being directed in a contrary direction to the water and steam, thereby ensuring a better employment of the same. This superheating generator is composed of two rows of pipes, one above the other, and crossing each other, which may be increased in number and lengthened at will. Two bends more or less salient, regulate the height of the water column and the evaporating and superheating surfaces, the pipes can be lengthened without lengthening the flues by moveable elbow pipes; thus it will always be easy to proportion the fire-place, the flue, and the heating surfaces to the desired effect to be obtained.

The mechanism shown and arranged for reversing these engines is two double couplings, which are arranged to shift together or simultaneously into one or other of a couple of pinions on each side of them, and running loose on each end of the crank shaft of the engine, these pinions gearing into a bevel wheel on the end of each of the shafts, I, which work all the valves, but as this arrangement may be modified or improved, it is therefore useless to describe it further.

The third arrangement is a simple reaction pyromotor, described also as utilising independently the same molecules arranged for the employment of mechanically compressed air, and for the dispersion of caloric after expansion so as not to increase the counter pressure; there is another form of regenerator used in this instance, serving to heat the air by means of steam, and also another reservoir arranged somewhat in the same way as the saturator, P, in fig. 1, but having one large inner-case instead of the tubes for containing mechanically compressed air, rendered air-tight by being surrounded with a casing filled with water or any other liquid, the pressure of which is kept in equilibrium with that of the air contained in its interior by means of an elastic chamber or of a chamber or capacity so made that it may easily be compressed; this reservoir communicates directly by a tube from one end with the two refrigerators arranged as described in reference to the first arrangement; in order to increase its capacity, the rest is identical with that of the double engine.

The fourth arrangement consists of a circulating superheating steam engine with a single horizontal cylinder, having an inlet slide valve on one side, and a separate outlet slide valve on the other. It has a horizontal tubular boiler, C, represented in sectional elevation and half end section in figs. 7 and 8 respectively, and is furnished with a superheating apparatus, E, consisting of a row of pipes running along the sides of the furnace, formed in one solid mass of cast-iron; and having also a saturating reservoir, G, with an outlet valve, for regulating at will the counter-pressure of the saturated steam, which counter-pressure is required to lubricate the surfaces of the cylinder when superheated steam is used.

The two slide valves and stuffing boxes are surrounded and protected, as well as lubricated by the saturated steam coming from the generating apparatus, and the subsidiary utilisation of caloric after it has expanded may take place if required; it may be supposed, in this instance, that it is employed either in evaporation for industrial purposes or in distilling, which operation may take place in vacuo or otherwise, and for this purpose serpentine tanks are used and heated by the escaping steam until complete condensation takes place; a distilling apparatus is also used together with a refrigerator the same as described in reference to the second arrangement. Thus the same water may be used indefinitely, and the same caloric several times; but should it be desired to use a duplex machine, similar to the double pyromotor shown in figs. 1, 2, and 3, the first cylinder would be used for the superheated steam, and its counter pressure could be employed for lubricating its surfaces, whilst the second cylinder could be used for the saturated steam, which would afterwards be condensed by a refrigerator, and its pressure would always be regulated by an outlet valve. Should it be desired not to use superheated steam, nor to utilise for any other purpose the caloric, or if it should be thought better to condense the steam, it is proposed, in order to do this artificially and in vacuo, to use a refrigerator of larger area than that shown at Q, in fig. 2, which has already been described.

Fig. 4.

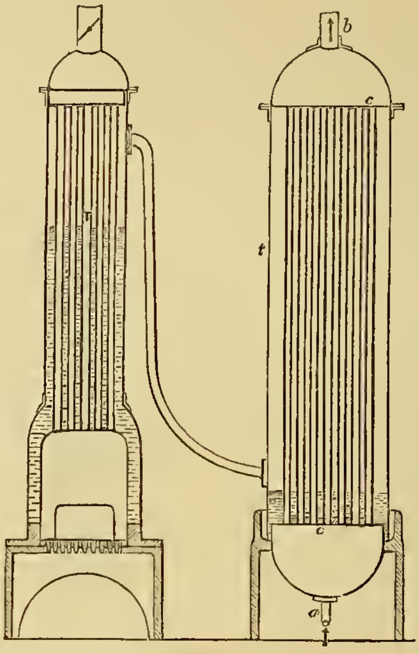
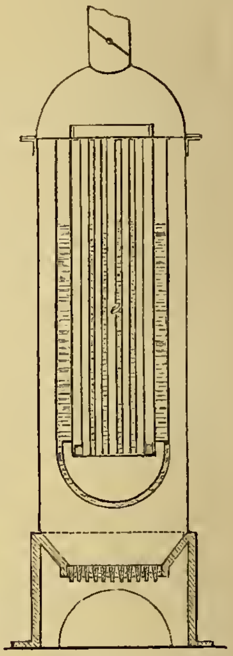


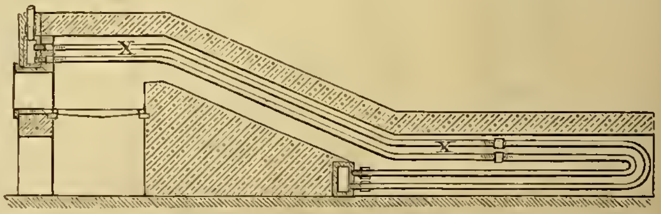
Fig. 5.



Condensation thus obtained allows the same water to be utilised indefinitely, it being continually distilled. The feeding pump, *s*, arranged to be worked by eccentrics on the crank shaft, could be so regulated as to draw up the distilled water at any required rate, and thus regulating with precision the normal level of the water in the boiler.

These applications, as will be seen, may be extended to all steam engines now in use, they offer the advantage of indefinitely utilising the same water, either by the artificial condensation of steam in vacuo, or by subsidiary utilisation of caloric, followed by the condensation of the escaping steam, which mode admits of the use of superheated steam.

Fig. 6.



Figs. 4, 5, 6, and 7, are sectional elevations illustrating most of the apparatus not shown in the first modification, figs. 1, 2, and 3, which are claimed under this invention. Figs. 4 and 5, are two different forms of the air generator, which may be used for the simple pyromotor.

Fig. 4 is described in reference to the third arrangement, the superheated steam being conveyed from the top of the generator, T, by a bent pipe to the lower end of the cylindrical case, *t*, containing the series of air heating tubes. The air to be heated enters the lower spherical end by the pipe, *a*, and after passing through the tubes where it is heated, passes off by the pipe, *b*, at the top, where it is formed into a hollow domed air space, the same as at the bottom, separated from the steam heating chamber by the two end tube plates, *c*.

Fig. 5 is an apparatus filled with a body in fusion, or with a liquid capable of being brought to a high temperature without becoming evaporated, and of a tubular cylinder, *e*, containing the air to be heated.

A third form of air generator is composed of serpentine pipes surrounded with cast-iron and heated directly to the desired temperature, somewhat analogous to the lower part of the generator, Q, in fig. 1.

Fig. 7.

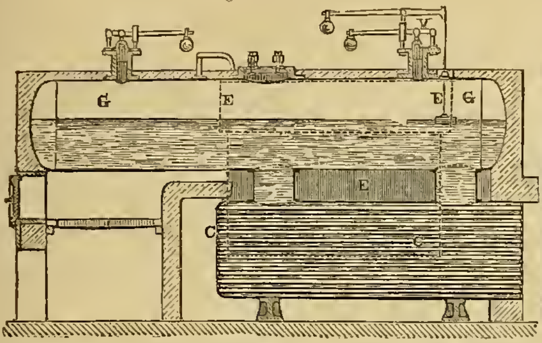


Fig 8.

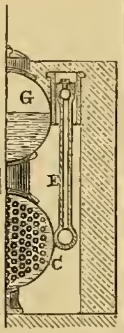


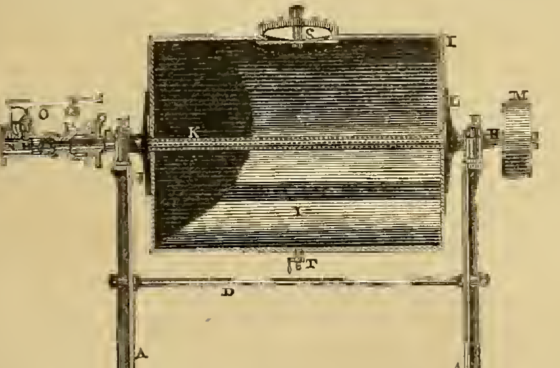
Fig. 6 is a sectional elevation of the superheating generator already described in reference to the second arrangement of a simple reacting pyromotor.

Figs. 7 and 8 are sectional elevation and half end section of a duplex cylindrical tubular steam boiler with a reversed draught intended for circulating engines, whether saturated or superheated steam be employed, and as already referred to under the fourth arrangement of this invention.

MANUFACTURE OF SOAP.

Robert Hodgson & Enoch Holden, *of Carlisle.—Patent dated April* 16, 1861.

This invention relates to an improved system or mode of manufacturing soap, whereby a very superior amount of economy and efficiency is secured. The subjoined engraving is a front sectional elevation of one form of apparatus which the patentees prefer to use in carrying out their improvements. The framework of the apparatus consists of the two parallel vertical cast iron standards, A, which are fixed by proper holding down bolts, upon foundation blocks of wood or stone, B, sunk with their upper surfaces flush or level with the floor line, C. These two vertical pillar frames are braced or held together by transverse bars, D, so as to form a compact and rigid framing. On the top of each standard is attached a bearing, E, for the purpose of carrying the two end spindles or shafts, G, H, of the rotatory cylinder or vessel, I. The end spindle, G, of this cylinder is tubular to answer as a steam thoroughfare, and it is attached to the corresponding end cover of the cylinder by means of a wide flange, J. This tube is continued right through the centre of the cylinder as at K, the portion inside the cylinder being perforated with minute orifices throughout its entire length. The opposite end spindle, H, is solid, and is similarly attached by a wide flange, L, to the end of the cylinder, I, an overhanging belt pully, M, being fitted upon it for the purpose of obtaining the necessary rotatory motion from a belt or band in the ordinary manner. The steam is supplied by the pipe or tube, N, which is in direct communication with the steam boiler or generator, and has fitted upon it a weighted lever, blow off, or safety valve, O, for the purpose of enabling the operator to blow off superfluous steam. This pipe, N, has formed upon it a stuffing box piece, P, with a packing gland, Q, so that a steam tight communication is formed and kept up between the stationary pipe, N, and the rotatory pipe or spindle, G. A self-acting stop valve is fitted in the pipe, N, at R, to close in an outward direction, so that the soap or the materials for the manufacture thereof contained in the cylinder, I, cannot blow back into the steam pipe when the pressure from any cause becomes too high in the cylinder. The ingredients or materials for the manufacture of soap are introduced by the man-hole or adjustable inlet, S, whilst a drawing off cock or valve is fitted on the cylinder at T, for the purpose of removing the contents at pleasure. When the cylinder or rotatory vessel, I, is duly charged with the necessary ingredients or materials for the manufacture of soap, it is closed quite steam tight, and steam is then turned on by a valve in the usual manner so as to flow through the pipe, N and G, into the perforated pipe, K, and thus reach the contents of the cylinder, which is meanwhile caused to revolve at a greater or less rate as may be desired. Prior to the admission of the steam to the cylinder, the drawing off tap or valve is turned up and opened, so as to allow the entering steam to force out the cold air; the valve is then closed. In this way the steam action, combined with the rotatory motion, brings about the saponifying action of the contained matters, in a most economical, rapid, and effective manner. When the requisite amount of saponification has been arrived at, the steam is turned off and the contents are withdrawn from the cylinder, which is again charged, and subjected to the combined steam and rotatory actions as before. In discharging, the machine is stopped and the cock or valve is turned down and opened, while the steam pressure is still on, to force out the soap. Although the patentee has hereinbefore described the cylinder, or steam and soap chamber, I, as revolving, it will be obvious to the practical man that the same, or a generally similar effect may be produced by making the cylinder stationary, whilst the perforated pipe, K, with other arms attached thereto, is caused to revolve, and thus effect the desired action. The cylinder, I, may also be made double, or with a steam jacket surrounding it, the steam being alone admitted into the jacket, or annular space, so as to separate upon the materials contained within the cylinder itself without mixing, or coming in direct contact with the materials.



MANUFACTURE OF PAPER PULP.

J. H. Johnson, *London and Glasgow*, (C. M. Gaguage, *Paris*).—*Patent dated Feb.* 21, 1861.

The improvements which form the subject of this communication to Mr J. H. Johnson relate to the application and use in the manufacture of paper pulp of certain vegetable productions, and to a peculiar mode of treating such vegetable substances with a view to their reduction into pulp for the manufacture of paper therefrom in lieu of from rags. The substances which it is proposed to employ for the preparation of paper pulp are common and well known plants, which can always be had in great abundance, the ligneous or woody portions thereof being separated from the resinous, gummy, and starchy matters which surround or impregnate them. The following are the vegetable productions which it is proposed to make use of in the preparation of pulp for paper-making, namely—the fir tree, maritime pine, larch, and all the coniferæ, junipers, willows, and osiers, tamarinds, plants of the genus *Spartium*, or broom, and *Scoparia;* also the genus *Juncus*, or rush, and *Genista*. Amongst herbaceous plants, those of the mallow tribe, and the *Bursaria:* as for example, the *Bursa Pastoris* and its varieties will be found particularly serviceable, also those of the genus *Hedysarum*, the *Polygonaceæ* and *Cyclamen;* the *Panicum Germanicum*, and tall *Panicum*, *Lupinus*, the *Sorghum*, or millet; also those plants of the genus *Lepidium*, or pepperwort, comprised under the order of *Cruciferæ;* also the dead leaves of the haricot and pea, and of the thistle.

The *Bursa Pastoris* is specially suited for the object in view, as it is easily cultivated, and affords a plenteous yield, and the same remark applies to the genus *Hedysarum*. As regards the *Coniferæ*, the collection of the fallen leaves or needles may be effected at any time. Of willows and osiers the bark alone is used; but the young green shoots of all kinds of trees and shrubs may be used entire, the shoots being cut up into short lengths by means of a machine similar to a chaff cutter, as are also the brooms, rushes, and young underwood. These fragments of plants are then submitted to the action of a bruising and tearing or disintegrating machine. The leaves or needles of the fir and pine are treated with alkaline baths for the purpose of softening them before they are subjected to the action of the disintegrating machine, after which the mass is washed and pressed, and submitted to the alternate action of an alkaline and a mineral acid bath, the strength of which is regulated according to the season of the year, or nature of the leaves or matter under treatment. After a time the leaves lose their resinous matter, and retain only the woody portions, mixed with a yellowish colouring matter, which is removed by mineral acid, when, after being again washed and pressed, the mass is ready for bleaching by any good process; but the special mode preferred is by causing the chloride employed to pass into an oxidised soda bath. None of the alkaline baths are wasted after use, but are filtered through suitably prepared charcoal, and may be used again repeatedly.

The following is a summary of the various processes or operations to which the several vegetable substances hereinbefore mentioned are subjected in their manufacture into paper pulp, namely—*First*, boiling in an alkaline liquor; *second*, draining off the alkaline liquor from the vegetable substances; *third*, breaking or bruising in any suitable machine for the purpose of disintegrating the fibres; *fourth*, carding in any suitable machine for that purpose; *fifth*, immersion in alkaline and acidulated baths alternately. This alternate use of the baths, the object of which is to permit of the recommencing of the alkaline treatment, may, however, be dispensed with, but the operation will require a much longer time to complete. *Sixth*, bleaching by any well known or other suitable process, such as the chloride of lime process for example; but the process before described is preferred. *Seventh*, pressure, obtained in any convenient manner, preference being given to the hydrostatic press so as to reduce the pulp to cakes or masses of small compass easy of transport.

LAW REPORTS.

Sewing Machines: Howe *v.* M'Kernan.—This was an application made to the Master of the Rolls for an injunction to restrain the defendant from selling or offering for sale any sewing machines purporting to be "Howe's sewing machines," and from representing himself to be the agent appointed for the sale of those machines.

The plaintiff had for many years manufactured and sold sewing machines, under the name of "Howe's sewing machines," and in the year 1860 he employed the defendant as his agent for the sale of the machines at 142 High Holborn. In June of the present year a company was established for the manufacture and sale of the machines, under the name of the "Howe Sewing Machine Company," and premises were opened at No. 8 Ludgate Street. The plaintiff was appointed sole agent of the company in England. The plaintiff gave notice to the defendant of the new arrangements that he had made, and that he would no longer require the defendant to act as his agent. In September the defendant removed from Holborn and opened a shop at 98 Cheapside, for the sale of sewing machines. He put on the window the words "Luke M'Kernan, late agent for the Howe sewing machine," in very large letters, with the exception of the word "late," which the evidence showed was in very small letters, and so placed as not to be seen by a casual observer. The defendant also issued advertisements stating that he was prepared to supply the Howe sewing machines, although it appeared that he had none of those machines for sale.

The Master of the Rolls, after observing that the word "late" was in such small characters and placed in such a position that he should have been unable to find it in the photograph of the shop unless he had been told where to look for it, said that the defendant was bound to have the word as clear and distinct as the other words, so that passers by might not be led to suppose that he was still the agent for the sale of the machines. The other part of the injunction must be modified by inserting the words "not manufactured by the plaintiff," as the Court could not restrain him from selling the machines if he acquired them in the ordinary way of business.

Mr Selwyn and Mr Jessel appeared in support of a motion.

Mr Hinde Palmer and Mr Joyce appeared for the defendant.

Carpets: Crossley *v.* Dixon.—Infringement.—This was in the Vice-Chancellor's Court, before Sir W. P. Wood, and was in the shape of a bill by Messrs Crossley, carpet manufacturers, at Dean Clough Mills, Halifax, praying relief against the defendant, a carpet manufacturer, at Kidderminster, in respect generally of certain alleged infringements of their patents. The facts were somewhat complicated, and the correspondence was very voluminous, but the case made by the bill was in effect that the defendant and his partner applied to the plaintiffs, in 1852, for a license to use their patent inventions for the manufacture of Brussels and velvet pile carpets. No actual license was granted, but after some negotiation the plaintiffs supplied the defendant with a number of looms constructed upon the principle of the several patents vested in them. These looms were furnished upon the terms of the defendant paying the cost of the looms, and a certain royalty upon every yard of carpet made by means of them. The defendant had subsequently purchased carpet looms from Messrs Sharp, Stewart, & Co., of Manchester, which were alleged by the plaintiffs to be infringements of their patents. The question as to the validity of the looms manufactured by Sharp & Co. had been tried in an action at law, which ultimately resulted in an award in favour of the plaintiffs for a large amount. Under these circumstances the present bill was filed against the defendant to obtain a declaration that the looms of Sharp & Co. used by him were constructed upon the principle of the plaintiffs' patents, and that the defendant, under the terms of the license granted to him, was bound to account for and pay royalties to the plaintiffs; or, alternatively, that if the license granted by the plaintiffs did not extend to the looms purchased from Sharp & Co., then that the defendant might be restrained from infringing the patents of the plaintiffs.

The defence set up was, first, that the defendant had not taken a license from the plaintiffs to work their patents, but had simply purchased looms from them on certain terms, so that he was not estopped as a licensee from questioning the validity of the patents claimed by the defendants; secondly, that the plaintiffs had not established the validity of the various patents claimed by them, and alleged to be embodied in the looms supplied to the defendant, and that no relief could be given in a court of equity until such validity had been established; thirdly, that no case of infringement had been proved.

The Vice-Chancellor said that he must confess, notwithstanding the very able argument on behalf of the defendant, that he was unable to understand the distinction which had been urged as to his not being a licensee from the plaintiffs. They supplied the defendant with machines, constructed according to the patents vested in them, at a certain price, and in addition demanded the payment of certain royalties for all carpets manufactured by their machines. It was true that no license was actually drawn up, but the payment of the stipulated royalty was clearly a payment for the user of the patents, and the defendant must have known that by paying this royalty he was estopped from disputing the validity of the patents. As to what patented inventions were or were not included in the machine for which the plaintiffs had granted the license to use there must be an inquiry, but the license to use the machine clearly included a license to use the inventions embodied in it, whatever they might be, and therefore the defendant was a licensee of those inventions. His Honour, after adverting to other points in the case, said that, looking at the construction of the arrangement between the parties, the correspondence, the difficulty which had been urged of identifying the patents, and the alleged hardship on the defendant, the case was wholly with the plaintiffs. It had been contended that this was a case for decision at law rather than in equity, but the question of account was one for the cognizance of this Court, as one arising between principal and agent, and not depending upon the plaintiff establishing his legal right. When this Court could do complete justice, parties ought not to be bandied about to other tribunals, and he had a strong impression, confirmed by the opinions of the common law judges, that, in cases of this description, a jury afforded a very inadequate mode of trying questions of similarity of patent, the result generally being that the case was referred to arbitration. There must be a declaration that the defendant became accountable to the plaintiffs for the royalties agreed to be paid by him as royalties due in respect of the user of the several patented inventions to which the plaintiffs were entitled and employed in the looms supplied to the defendant.

Certain other declarations and inquiries followed in the decree and a direction that the costs up to the hearing must be paid by the defendant.

Trade Marks for Thread: Carter *v.* Westhead.—Injunction.—This case, in the Court of Chancery, before the Lords Justices of Appeal relating to "French cross embroidery cotton," or "cross embroidery cotton," or "cross cotton," with green labels attached to each hank or skein, came before the Court on motion of the defendant to dissolve an injunction granted on the 11th of July last (at which time the matter was very fully reported in the *Practical Mechanic's Journal*) by Vice-Chancellor Wood, restraining the defendant from selling cottons as above designated, or with labels similiar to those of the plaintiff, not manufactured by the plaintiff, and also from using any labels, &c., calculated to lead purchasers to believe that they were buying cotton manufactured by the plaintiff. The motion came on upon evidence on both sides in addition to that which was before the Vice-Chancellor. His Honour remarked upon the fact of the defendant using labels of the same colour, "green," as those adopted by the plaintiff, and on the appeal an array of not less than 80 labels of that colour were produced, to show that green was the almost universal colour used in the trade for labels. The evidence of Mr Hill as to the conversation that he alleged took place on the purchase of cotton was contradicted by two witnesses, and it was shown that the defendant used an anchor on his dark-coloured label, instead of the cross adopted by the plaintiff, and the initials "W. T." for "C. B." It was also proved for the defence that the use of French words on labels was a very general practice in the trade, wherever the cotton might be manufactured.

In support of the order of the Court below, it was urged that the plaintiff's goods had been offered for sale under a representation that they were goods manufactured by him, or representations necessarily leading the purchaser to the belief that they were, and that the fact of using labels containing so much of resemblance to those of the plaintiff would, conjointly with the other fact, induce the Court to sustain the injunction. The learned counsel remarked upon the evidence of Mr Hill, and referred to the testimony of the two witnesses by whom he was impugned, observing that if Mr Hill was, as he had been charged with being, a spy, at all events he had performed a disagreeable duty honourably, and that his two adverse witnesses were themselves mistaken in their respresentation of the conversation that took place at the time of the purchase of the cotton, and that Hill was not proved to have said anything not warranted by truth. With regard to the labels, that on green paper was comparatively immaterial, for it was only upon the large packages of hanks or skeins of cotton, but the smaller label on each dozen skeins, and on each skein the dark label, with the anchor on them, had each a string so wound round it as to cover the fluke of the anchor, and to make it look remarkably like the cross adopted by the plaintiff, the colour in both cases being bronze. It was quite plain that the anchor had been adopted, not as a sign or mark of any particular cotton, but as an imitation or resemblance of a cross used by the plaintiff, and in order to make a purchaser believe he was purchasing "cross cotton," cross cotton being the manufacture of the plaintiff.

Their Lordships discharged the order of the Vice-Chancellor, and directed the matter to stand over till the tenth day of Easter term, with liberty to the plaintiff to bring such action as he may be advised, and with liberty to either party to apply. All costs reserved.

MECHANIC'S LIBRARY.

Bridges, Diagrams to Calculate Iron, 4to, 2s 6d. Campin.
Chemistry, Descriptive and Theoretical, part 1, 8vo, 9s. Odling.
Geography, Atlas of Physical, 10s 6d. cloth. Philips.
Geometry, Euclid's Elements of, new ed., 8vo, 10s. cloth. Potts.
Geometry, Euclid's Plane, Books 3 to 6, 12mo, 4s 6d. cloth. Green.
Household Management, Book of, crown 8vo, 7s 6d. cloth. Beeton.
Lead Ore in Veins, Deposition of, 8vo, 25s. cloth. Wallace.
Literature, History of English, 12mo, 3s 6d. cloth. Collier.
Measurement, English and French, Compared, 1s. Temple.
Mineralogy, Glossary of, crown 8vo, 12s. cloth. Bristow.
Physics, Elementary Treatise on, parts 1 and 2, 1s. Ganst.
Pocket Companion, Millwright and Engineer's, 13th ed., 5s. cloth. Templeton.
Photographs, Aristic Colouring as applied to, crown 8vo, 6s 6d. Wall.
Railway, Channel, Connecting England and France, 2s 6d. Chalmers.
Sciences, Circle of, new ed., vols. 8 and 9, 5s. cloth.
Slide Rule, Handbook of the, 12mo, 6s. Bayley.

REVIEWS OF NEW BOOKS.

Abridgments of Specifications Relating to Photography. Printed by Order of the Commissioners of Patents; fcap. 8vo. Pp 165. London: Eyre & Spottiswoode.

This work is one of the series of highly useful manuals, which the Commissioners of Patents are now issuing, and is the nineteenth of the series. The Superintendent of Specifications, Mr B. Woodcroft, certainly is entitled to the sincere thanks of all who are interested in inventions, for the manner in which this portion of his labours has been carried out. To those in search of information upon the patents comprised within a certain branch of manufactures, or desirous of learning whether a certain idea has, or has not been carried into effect, these works offer by far the readiest means of obtaining their object. Eminently useful as the several indexes of patents which the commissioners have published are, they do not for one moment bear comparison in point of utility with the abridgments. In the one the reader has but a bare list of names of patentees, and the titles of their inventions, but in the other he has the pith of the specifications placed before him, and by this means he is enabled to take in at a glance the whole of the subject matter of each patent. Widely different is the facility of obtaining information now a days upon these matters, to what it was before the alteration in the Patent Law; then the explorer had to pay fees at every step for each individual search; the specifications were handed to him in the "roll," a cylindrical mass of parchment, some eight or nine inches in diameter, and formed by attaching a number of narrow skins together until the whole made a roll of some twenty or thirty yards in length. A crude and barbarous system the reader will say, but worse remains behind; the specifications were engrossed on these skins in the Elizabethan character, or engrossing hand, requiring a practised eye to decipher it. Many and many a weary day has the writer of these lines spent in cold and cheerless rooms poring over these Egyptian like documents, with very often a nervous inventor by his side, anxious lest his treasured idea should be forestalled, and looking with blank despair upon the rolls, as they were laboriously but patiently waded through one by one. For in those days there were giants, and specifications comprising fifty or sixty skins were by no means uncommon. The bare mention of these matters is sufficient to give the public some idea of what it owes to Mr Woodcroft and his colleagues in making the patent records really and truthfully patent to all. There, however, are several points in the management of the Great Seal Patents Office which calls loudly for reform. A great deal too much time is taken up in getting up the annual indexes. From the manner in which they are entered up from day to day, the alphabetical and subject matter indexes should appear early in the following year, and not at the latter end, as is the case at present. The abridgments should also be published from year to year, so as to keep each subject as nearly as possible up to the present time. Particular attention should also be paid to economy of price, too much expense is at present lavished upon paper and typography. It should always be borne in mind that the great bulk of the readers of these works are men of limited means. The abridgments of such subjects as India-rubber, costing ten shillings, Electricity, eight and sixpence, Bleaching, nine and sixpence, should be published in sections so as to bring them within the means of a wider class of buyers.

The compilation of the volume before us was entrusted to Mr Wellenn, whose abridgments of the specifications relating to electricity and magnetism we had occasion to notice at the time of publication. The art of photography in its development as an industrial occupation, is perhaps the most extraordinary instance of the kind on record. Within a few years it has become the bread winner of tens of thousands of the human family. In Paris alone it was recently ascertained from official sources, that upwards of 10,000 persons were deriving their subsistence directly from the practice of this art. It has, moreover, called into existence numerous special trades for the supply of particular articles, and it has indirectly been the means of improvement in many branches of manufacture, in consequence of its requiring various chemicals, paper, and other matters as free as possible from impurities. Photography has also proved a perfect god-send to the optician, and to the philosophical instrument maker, as well as to the ornamental metal workers both at home and abroad. Recently, too, the best resources of the bookbinder and the ornamental mount maker has been largely called into requisition for the production of the numerous beautiful albums for the *carte de visite* portraits that we see in every place of public resort. In this volume we find that two hundred and fifty six patents have been granted for inventions connected with photography. The reader has by means of well arranged indexes, the whole of this large body of matter brought immediately under his eye, so that he is enabled to turn at once to a particular patent, either under the name of the patentee, or the subject matter of the specifications. Of the utility of these abridgments there cannot be the shadow of a doubt; but it is very desirable that the publication of the series be completed as soon as possible, and be kept up year by year.

CORRESPONDENCE.

MUZZLE-LOADING RIFLE-CANNON.

More than twenty years ago, I successfully proved the efficacy of rifle-cannon loading at the muzzle, by firing some of my elongated percussion rifle-shells from my rifled one-pounder brass cannon, at Woolwich, in presence of the late Sir Thomas Hardy, the late Lord Hardinge, and several other officers of high rank. Lord Hardinge was so pleased with the results, that he wrote me a letter congratulating me on my success. After enormous expenses in bolstering up the Armstrong breech-loading guns, we are now it seems again brought back to the muzzle-loading principle.

J. Norton.

Kingstown, November, 1861.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION.

SECTION B. CHEMICAL SCIENCE.

Report on the Manufactures of the South Lancashire District.

"On the Effect of Great Pressures combined with Cold on the Six Non-condensable Gases," by Dr Audrews.

In this communication the author gave an account of some results already obtained in a research with which he is still occupied on the changes of physical state which occur when the non-condensable gases are exposed to the combined action of great pressures and low temperatures. The gases when compressed were always obtained in the capillary end of thick glass tubes, so that any change they might undergo could be observed. In his earlier experiments the author employed the elastic force of the gases evolved in the electrolysis of water as the compressing agent, and in this way he actually succeeded in reducing oxygen gas to 1-300th of its volume at the ordinary pressure of the atmosphere. He afterwards succeeded in effecting the same object by mechanical means, and exhibited to the Section an apparatus by means of which he had been able to apply pressures, which were only limited by the capability of the capillary glass tubes to resist them; and while thus compressed the gases were exposed to the cold attained by the carbonic acid and other bath. Atmospheric air was compressed by pressure alone to $\frac{1}{371}$ of its original volume and by the united action of pressure and a cold of —196° F to 1·675th; in which state its density was little inferior to that of water. Oxygen gas was reduced by pressure to 1·324th of its volume, and by pressure and cold to 1·554th; hydrogen by the united action of cold and pressure to 1·500th; carbonic oxide by pressure to 1-278th; by pressure and cold to 1·278th; nitric oxide, by pressure to 1-310th, by pressure and a cold of—100° F. to 1·680th. None of the gases exhibited any appearance of liquefaction even in these high states of condensation. The amount of contraction was nearly proportional to the force employed, till the gases were reduced to from about 1-300th to 1·350th of their volume; but, beyond that point, they underwent little further diminution of volume from increase of pressure. Hydrogen and carbonic oxide appear to resist the action of pressure better than oxygen or nitric oxide.

"On the Thermal Effects of Elastic Fluids." by Dr Joule and Prof. W. Thomson.

The President exhibited some Photographs of different Spectra, and read a paper on the subject.

The apparatus by which the spectra may be photographed consists of an ordinary camera obscura attached to the end of a long wooden tube, which opens into a cylindrical box, within which is a prism glass, or a hollow prism filled with bisulphide of carbon. If the prism be so adjusted as to throw the solar rays, reflected from a heliostat, upon the screen of the camera, and the wires which transmit the sparks from a Ruhmkorff coil are placed in front of the uncovered portion of the slit, the two spectra are simultaneously impressed. The solar beam is easily intercepted at the proper time by means of a small screen, and the electric spectrum is allowed to continue its actions for two, or three, or six minutes as may be necessary. He did not find that anything was gained in distinctness by interposing a lens of short focus between the slit and the wire which supplied the sparks, with the view of rendering the rays of electric light parallel like those of the sun, owing to the absorbent action of the glass weakening the photographic effect; and the flickering motion of the sparks being magnified by the lens, rendered the lines less distinct than when the lens was not used. Although with each of the metals (including platinum, gold, silver, copper, zinc, aluminium, magnesium, iron), when the spark was taken in air, he obtained decided photographs, it appeared that in each case the impressed spectrum was very nearly the same, proving that few of the lines produced were those which were characteristic of the metal. The peculiar lines of the metal seemed chiefly to be confined to the visible portion of the spectrum, and these had little or no photographic power. This was singularly exemplified by repeating the experiment upon the same metal in air, and in a continuous current of pure hydrogen. Iron, for example, gave, in hydrogen, a spectrum in which a bright orange and a strong green band were visible, besides a few faint lines in the blue part of the spectrum. Although the light produced by the action of the coil was allowed to fall for ten minutes upon a sensitive collodion surface, scarcely a trace of any action was procured; whilst, in five minutes, in the air, a powerful impression of numerous bands was obtained. It was remarked by Mr. Talbot that, in the spectra of coloured flames, the nature of the acid did not influence the position of the bright lines of the spectrum, which he found was dependent upon the metal employed, and this remark had been confirmed by all subsequent observers. There was obviously a marked difference between the effect of intense ignition upon most of the metallic and the non-metallic bodies. The observations of Plücker upon the spectra of iodine, bromine and chlorine, show that they give, when ignited, a very different series of bands to those which they furnished by absorption, as Dr. Gladstone had already pointed out; but it was interesting to remark that, in the case of hydrogen, which, chemically, was so similar to metal, we have a comparatively simple spectrum, in which the three principal bright lines correspond to Fraunhofer's dark lines, C. F. and G. It was, however, to be specially noticed that the hydrogen occasioned no perceptible absorptive bands at ordinary temperatures in such thickness as we would command in our experiments, and the vapour of boiling mercury was also destitute of any absorptive action, although when ignited by the electric spark it gave a characteristic and brilliant series of dark bands. The following experiment suggested itself as a direct test of Kirchoff's theory. Two gas-burners, into which were introduced chloride of sodium on the wick of the spirit lamp, were placed so as to illuminate equally the opposite sides of a sheet of paper partially greased. The rays of the electric light screened from the photometric surface, suitably protected, were made to traverse one of the flames. If the yellow rays of the light were absorbed by the sodium flame, the light emitted laterally by the flame should be sensibly increased. The experiment however, failed to indicate any such increase in the brilliancy of the flame, possibly because the eye was not sufficiently sensitive to detect the slight difference which was to be expected.

"On the Emission and Absorption of Rays of Light by certain Gases," by Dr J. H. Gladstone.

"On an Aluminous Mineral from the Upper Chalk near Brighton," by Dr J. H. and Mr G. Gladstone.

"On the Chemical Composition of some Woods employed in the Navy," by Dr Crace Calvert.

"On the Chemical Composition of Steel," by Dr Crace Calvert.

"On the Solvent Powers of Weak and Strong Solutions of Alkaline Carbonates on Uric Acid Calculi," by Dr W. Roberts.

"On certain Difficulties in the way of separating Gold from Quartz," by Dr Smith (of Sydney).

"On Atmospheric Ozone," by Dr. Moffat.

"On Sulpheretted Hydrogen as a Product of Putrefaction," by Dr Moffat.

"On the Composition and Valuation of Superphosphates," by Prof. Galloway.

"On Morin, and the Non-existance of Moro-tannic Acid," by Prof. Delffs.

"On the Constitution of Paranaphthaline or Anthracine, and some of its Decomposition Products," by Prof. Anderson.

"On Piperic and Hydro-piperic Acids," by G. C. Foster.

"On the Cohesion Figures of Liquids," by Prof. Tomlinson.

"Report on Field Experiments and Laboratory Researches on the Constituents of Manures essential to Cultivated Crops," by Dr Voelcker.

"On the Composition of Crystallized Moroxite, from Gumillo, near Alicante." by Dr Voelcker.

"On some Points in Connexion with the Exhaustion of Soils," by J. B. Lawes and Dr J. H. Gilbert.

The question of the exhaustion of soils is one of peculiar interest at the present time, not only on account of the great attention now paid to the waste of manuring matters discharged into our rivers in the form of Town sewage, but also from the fact that Baron Liebig has recently maintained that our soils were suffering progressive exhaustion from this cause, and predicts certain, though it may be distant, ruin to the nation if our modes of procedure be persevered in. The question was one of chemical facts; and the authors had it in view to treat it much more comprehensively than they were enabled to do on the present occasion. They proposed, by way of illustration, to bring forward one special case of progressive exhaustion, occurring in the course of their own investigations, and then to contrast the conditions of that result with those of ordinary agriculture. They had grown wheat for eighteen years consecutively on the same land, both without manure, and with different constituents of manure, and they had determined the amounts of the different mineral constituents taken off from each plot. Numerous tables of the results were exhibited. The variation in the composition of the ash of both grain and straw dependent on variation of season was first pointed out. Reverting to the main subject of inquiry, it appeared. that when ammoniacal salts were used alone, year after year on the same land, the composition of the ash of both grain and straw showed an appreciable decline in the amount of phosphoric acid, and that of the straw a considerable reduction in the percentage of silica. The average yield of mineral constituents was very much increased by the use of ammoniacal salts—much more so than when a liberal supply of mineral constituents alone was used. But in neither of these cases was there anything like the yield of mineral constituents that was obtained when the ammoniacal salts and mineral manures were used together, or when farm-yard manure was employed, The greatest deficiency indicated was in the silica and the phosphoric acid; and next in order came potash and magnesia. The exhaustion here apparent was, however, not to be wondered at, when it was considered that in these experiments, in which both corn and straw had been annually removed without the usual periodic returns of farm-yard manure, there had been taken from the land, by the use of ammoniacal salts alone for sixteen years, as much silica as would require four hundred years, and as much phosphoric acid as would require thirty-two years, and as much potash as would require eighty-two years of ordinary rotation with home manuring, and selling only corn and meat, to remove. Again, in the experiments of the Rev. Mr Smith, of Lais-Weedon, on the growth of wheat year after year on the same land, the authors estimated that he annually took from each acre about seven times as much potash, about three and a half times as much phosphoric acid, and about thirty-seven times as much silica, as the ordinary course of practice would do; and yet, after some fifteen years, his crops were said to be not at all failing. The authors did not recommend such practice as that quoted either from their own or Mr Smith's experiments; but the instances given showed the capabilities of certain soils; and in one case the conditions under which the point of comparative exhaustion had been reached. It was of course impossible to state the limits of the capability of soils generally, so infinitely varied was their composition; but it would be useful to give an illustration on this point. Taking the average of forty-two analyses of fourteen soils, of very various descriptions, it was estimated that it would require, of ordinary rotation with home manuring and selling only corn and meat, about two thousand years to exhaust the potash, about one thousand years to exhaust the phosphoric acid, and about six thousand years to exhaust the silica, found to be soluble in dilute hydrochloric acid, reckoning the soil to be one foot deep. Many soils doubtless had a composition inferior to that here supposed. In a large proportion, however, the amounts of the constituents assumed to be soluble in dilute acid would probably be available for plants before the expiration of the periods mentioned; whilst in a large proportion there would still be further stores eventually available, within a greater or less depth from the surface. But in practice the exhaustion was really by no means so great as supposed in the above illustrations. Where there was no import of cattle food, or artificial, as town, manures, the sale of mineral constituents in corn and meat would be much less than were taken in the authors' estimates. Those amounts of exports from the farm could only be reached when cattle food, or direct manures, were purchased by the farmer; and wherever these courses were pursued judiciously, there was always much more phosphoric acid (the most easily exhausted constituent) brought upon the land than could be exported in the increase of produce obtained. In such cases in many soils potash was more likely to become deficient. Then, again, a not inconsiderable portion of the refuse of our towns was derived from imported food or other matters not obtained from our own cultivated land; whilst by no means the whole of it reached the sewers, and thence our rivers. In conclusion, whilst the authors believed that modern practices did not tend to exhaustion in anything like the degree that had been supposed by some, they would nevertheless insist upon the importance of applying to agricultural purposes as much as possible of the valuable manuring matters of our towns. It was at the same time certain, that if these were to be diluted with water in the degree recognized under the present system, they could then, unless in exceptional cases, be only applicable on the large scale to grass land; and, so far as this was the case, they would of course, not directly contribute to the restoration to the land under tillage of the mineral constituents sent from it in its produce of corn and meat.

"On a particular Decomposition of Ancient Glass," by H. Deane.

"On the Composition and Properties of the Water of Loch Katrine, as supplied to Glasgow," by Dr Wallace.

"On the Proportion of Arsenic present in Paper-Hangings," by Dr S. Macadam.

"On the Proportion of Tin present in Tea-Lead," by Dr S. Macadam.

"On the Construction of Gas-Burners for Chemical Use," by J. J. Griffin.

"On Perchloric Acid and its Hydrates," by Prof. Roscoe.

"Note on the Sulphur Compound formed by the Action of Sulphurretted Hydrogen on Formiate of Lead at a High Temperature," by W. H. Hurst.

"On Vesicular Structure in Copper," by Drs Russell and Matthiessen.

"On the History of the Alkali Manufacture," by W. Gossage.

"On the Evolutions of Ammonia from Volcanoes," by Dr Daubeny.

"On an Apparatus for the rapid Separation and Measurement of Gases," by Drs Williamson and Russell.

"On Madder Photographs," by J. Mercer.

"On a Specimen of Meteoric Iron from Mexico," by Prof. Tennant.

"On Purifying Towns from Sewage by Means of Dry Cloacæ," by Dr J. H. Lloyd.

"On an Economical Mode of Boiling Rags, &c., with Alkaline Ley, by Dr S. Macadam.

"On the Action of Rennet on Milk," by Dr Voelcker.

"On Natural Combinations of Phosphate with Alkalies," by Dr Voelcker.

"On the Separation of Ammonia from Coal Gas," by W. Mariott.

SECTION C.—GEOLOGY.

Opening Address of the President Sir R. I. Murchison.

"Sketch of the Geology of Manchester," by E. W. Binney.

"On the Recent Encroachments of the Sea on the Shores of Torbay," by W. Pengelly.

"On the Excess of Water in the Region of the Earth about New Zealand; its Causes and Effects," by J. Yates.

"Notes on two Ichthyosauri to be exhibited to the Meeting," by C. Moore.

"On the Relation of the Eskdale Granite at Black Comb to the Schistose Rocks," by J. G. Marshall.

"On a Dinosaurian Reptile (*Scelidosaurus Harrisoni*) from the Lower Lias of Charmouth," by Prof. Owen.

"On the remains of a Plesiosaurian Reptile (*Plesiosaurus Australis*) from the Oolitic Formation in the Middle Island of New Zealand," by Prof. Owen.

"On the Elseworth Rock and of the Clay above it," by H. Seely.

"On the Sandstones and their associated Deposits of the Valley of the Eden and the Cumberland Plain," by Prof. Harkness.

"On some Phenomena connected with the Drifts of the Severn, Avon, Wye, and Usk," by Rev. W. S. Symmonds.

"On the the Pleistocene Deposits of the District about Liverpool," by G. W. Morton.

"Notice of some Facts in Relation to the Postglacial Gravels of Oxford," by Prof. Phillips.

"On a new Bone-cave at Brixham, by W. Pengelly.

"Remarks on the Bone-caves of Craven," by T. W. Barrow.

"On the Red Crag Deposits of the County of Suffolk," by W. Whincope.

"Palæontological Remarks upon the Silurian Rocks of Ireland," by W. H. Baily.

"Maps and Sections recently published by the Geological Survey," exhibited by Sir R. I. Murchison.

"Results of the Geological Survey of Tasmania," by C. Gould, with Maps.

"On the Faults of the Lancashire Coal-field," by H. Green.

"On Isometric Lines, and the relative Distribution of the Calcareous and Sedimentary Strata of the Carboniferous Rocks," by E. Hull.

"On the Old Red Sandstone of South Perthshire," by Prof. Harkness.

"Report on Dura Den," by Rev. Dr Anderson.

"On the Aqueous Origin of Granite," by A. Bryson.

"On the Age of the Dartmoor Granites," by W. Pengelly.

"On the Nature of Sigillariæ, and on the Bivalve Shells of the Coal," by J. W. Salter.

"On the Later Changes in the Physical Geology of British North America, with Notes on the Auriferous Drifts of the Pacific Slope," by Dr Hector.

"On the Age and Distribution of the Mesozoic Coal of the Pacific Coast and Saskatchewan Prairies," by Dr Hector.

"Notice of Elongated Ridges of Drift, common in the South of Scotland, called Kaims," by D. Milne Home.

"On the Gold of North Wales," by T. A. Readwin.

"On the Burnley Coal-field and its Fossil Contents," by J. T. Wilkinson, and J. Whitaker.

"On certain Markings in Sandstones," by W. Patterson.

"On the Laws discoverable as to the Formation of Land on the Globe," by Rev. C. R. Gordon.

"Information from Prof. Haidinger, respecting the Present State of the Imperial Geological Institution of Vienna," communicated by Sir R. I. Murchison.

"On the Details of the Carboniferous Limestone, as laid open by the Railway Cutting and Tunnel near Almondsbury, North of Bristol," by Mr Richardson.

"Report on Examination of Minerals," by A. Gages.

"Report of Earthquake Experiments," by R. Mallet.

"An Examination of some Points in the Doctrine of the Internal Heat of the Globe," by Prof. W. Thomson.

"On the Extinct Volcanoes of Australia," by J. Bonwick.

SECTION D.—ZOOLOGY AND BOTANY.

"On the Cervical and Lumbar Vertebræ of the Mole (*Talpa Europœa,* L.)," by Prof. Owen.

"Prof. Owen afterwards read a paper "On Some Objects of Natural History from the Collection of M. Du Chaillu."

The reading of this paper was followed by a discussion in which Prof. Owen, Dr Lankester and M. Du Chaillu took part.

Dr Wright, of Dublin, read a communication from Dr J. E. Gray, "On the Height of the Gorilla."

Mr J. G. Jeffreys exhibited specimens of the *Sphœnotrochus borealis* of Fleming, which had been taken in the dredge off the coast of Zealand.

Dr Ogilvie read the Report of the Aberdeen Dredging Committee.

"On the Anatomical Characters of Cypræa," by Dr T. Alcock.

"On the Relation between the Pinnate and Palmate Leaves," by T. M. Masters.

Brief Summary of a Report on the Flora of the North of Ireland," by Dr G. Dickie.

"Report on the best Mode of preventing the Ravages by Teredo and other Marine Animals in our Ships and Harbours, for the Consideration of which a Committee was formed at the last Meeting of the Association," by Mr Jeffreys.

"Preliminary Report on the Dredging Committee for the Mersey and Dee," by Dr Collingwood and Mr Byerly.

Mr M'Andrew read a short account of the proceedings of the General Dredging Committee.

"Report on the Present State of our Knowledge of the Genus Apteryx living in New Zealand," by P. L. Sclater.

"On the Ovicells of the Polyzoa, with reference to the views of Prof. Huxley," by the Rev. T. Hincks.

"On the Influence exerted by Light on the Function of Plants," by Dr Daubeny.

Dr Dauheny also read a paper "On the Functions discharged by the Roots of Trees," and made some observations "On a Violet peculiar to the Calamine Rocks, in the neighbourhood of Aix-la-Chapelle."

"On the Method of Mr Darwin, in his Treatise on the Origin of Species," by H. Fawcett.

"On a Scheme to induce the Mercantile Marine to aid in the Advancement of Science by the intelligent Collection of Objects of Natural History," by Dr Collingwood.

"On the Flora of Manchester," by L. H. Grindon.

Dr Gibb read a paper "On the Arrest of Puparial Metamorphosis of the *Vanessa Antiopa*, the well-known Camberwell Beauty."

Dr Cleland read a paper "On the Anatomy of *Orthragoriscus Mola*, the short Sunfish.'

A paper was read from Mr A. Stansfield "On new British Species of Blechnum."

"Notes on the Variation of *Tecturella grandis,*" by P. P. Carpenter.

"On the Cosmopolitan Operations of the Smithsonian Institution," by P. P. Carpenter.

"On a new Mining Larva, recently discovered,' by H. T. Stainton.

"On the Development of the Hydroid Polyps, Clavatella and Stauridea, with Remarks on the Relation between the Polyp and its Medusoid, and between the Polyp and the Medusæe," by the Rev. T. Hincks.

"On Barraguta Cotton from the Plains of the Amazon, and on the Flax-fibre Cotton of North America," by W. Danson, of Liverpool.

"On the Absorbing Power of the Roots of Plants," by Dr Jepen.

Dr Rolleston read a paper from Mr Albany Hancock "On certain Points in the Physiology of the Dilbranchiate Cephalopods."

"On some Points of interest in the Structure and Habits of Spiders," by Tuffen West.

"Remarks on the late Increase of our Knowledge of Struthious Birds," by P. L. Sclater.

"On *Daphnia Schæfferi* and other Fresh-Water Crustacea," by the Rev. A. R. Hogan.

"On the Arrangement of Hardy Herbaceous Plants adopted in the Botanic Garden, Liverpool," by the Rev. H. Higgins.

"On the Migration of the Herring," by T. M. Mitchell.

A Report was then read from Mr Peach, "On the Herring Fishery of the North of Scotland."

SUB-SECTION D.—PHYSIOLOGY.

"On the Connection between the Functions of Respiration and Digestion." by Dr G. Robinson.

"Report on the Influence of Prison Dietary and Punishments on the Bodily Functions of Prisoners," by Dr E. Smith and J. R. Milner.

"On the Existence and Arrangement of the Fovea Centralis Retinæ in the Eyes of Animals," by Prof. H. Müller.

"On Chloroform Accidents, and some new Physiological Facts as to their Explanation and Removal," by Dr C. Kidd.

"On the Action of Lime on Animal Matter," by Dr J. Davy.

"On the Physiological and Medicinal Properties of Sulphate of Aniline, and its use in the Treatment of Chorea," by Dr J. Turnbull.

"Report of the Influence of Prison Dietary and Punishments upon the Bodily Functions of Prisoners, Part II.," by Dr E. Smith and J. R. Milner.

"On the Action of the Eustachian Tube in Man, as demonstrated by Dr Politzer's Otoscope," by J. Toynbee.

"On the Blood of the Common Earthworm," by Dr J. Davy.

"On Certain Points in the Anatomy of the Insectivora," by Dr G. Rolleston.

"Upon the Influence of the Sympathetic Nerve on Voluntary Muscles, as witnessed in the Treatment of Progressive Muscular Atrophy by Secondary Electric Currents," by Prof. Remak.

"On the Structure and Growth of the Elementary Parts (Cells) of Living Beings," by L. Beale.

"On the Question whether the Hair is or is not subject to Sudden Change in Colour," by Dr J. Davy.

"Physiological Researches on Resuscitation," by Dr B. W. Richardson.

"On some Points in the Anatomy of Insectivora," by Dr. Prof. Rolleston.

"On certain Points in the Anatomy and Physiology of the Dibranchiate Cephalopods," by A. Hancock.

"Observations on the Encephalon in Mammalia," by R. Garner.

"On the Occipital Vertebra in Osseous Fishes," by C. Robinson.

"Observations on the Encephalon of Mammalia," by R. Garner.

"On Prison Dietary," by Dr Mouatt.

"On Nerve without End," by Prof. Hyrtl.

"On the Pneumatic Processes of the Occipital Bone," by Prof. Hyrtl.

"On Portions of Lungs without Blood-Vessels," by Prof Hyrtl.

"On some Points in the Anatomy of Insectivora," by Prof. Rolleston.

"On a Method of Craniometry, with Observations on the Varieties of Form of the Human Skull," by Dr Cleland.

"On the Influence of the Season of the Year on the Human System," by Dr E. Smith.

"On the Anatomy of Pteropus," by Prof. Rolleston.

"On the Homologies of the Lobes of the Liver in Mammalia," by Prof. Rolleston.

"Physiological Researches on the Artificial Production of Cataract," by Dr Richardson.

"The Physical and Physiological Processes involved in Sensation," by Dr J. D. Morrell.

THE ASSOCIATION FOR THE PREVENTION OF STEAM BOILER EXPLOSIONS.

At the last ordinary monthly meeting of the executive committee of this association, W. Fairbairn, Esq., C.E., F.R.S., president, in the chair, Mr L. E. Fletcher, chief engineer, presented his monthly report, from which we have been furnished with the following extracts:—During the past month 438 engines have been examined, and 595 boilers; 22 of the latter being examined specially, 14 internally, 43 thoroughly, and 516 externally. The following defects have been found:—Fracture, 8 (2 dangerous); corrosion 36 (7 dangerous); safety-valves out of order, 9; water gauges ditto, 14; pressure gauges ditto, 8; blow-off cocks ditto, 54 (1 dangerous); furnaces out of shape, 2; deficiency of water, 2; over pressure, 14—total, 147 (10 dangerous); boilers without glass water gauges, 13; ditto without pressure gauges, 10; ditto without blow-off cocks, 59; ditto without feed back press valves, 93. In my last report I called attention to the application of steam-jackets to cylinders, pointing out their importance as an agent "for effecting economy in the use of steam." I now wish to allude to a kindred and equally important subject—viz., that of *Superheating*, the economy derived from which has now become established by general experience, and in marine engines has, in many cases, effected as high a saving as 30 per cent. I scarcely anticipate such a result as this from its application to Lancashire mill engines; still I am confident that a very considerable saving would be effected, while at the same time, the vacuum would be improved, the temperature in the hot wells reduced, and less injection water required, which, to steam users having cooling ponds of limited area, would be most important. These results are mainly due to the prevention of condensation and re-evaporation on the internal surface of the cylinder, as explained in my last report relative to the action of the steam-jacket; so that the effect of superheating the steam, or coating the cylinder with a steam-jacket, is very similar. The application of the jacket, however, to cylinders can only be made at the time of construction, except with considerable difficulty, while the principle of superheating can be applied to old engines as an auxiliary without alteration to the existing arrangements. The subject of superheating has been sadly bugbeared. It has been reported that the use of superheated steam would destroy the surface of the cylinder, piston, and slides, by preventing lubrication; also that it would corrode the metal; that it was highly explosive, productive of great pressure, and altogether dangerous and difficult to deal with. Actual experience, however, has proved that these objections are entirely visionary, and I have only within the last few days been assured by the superintending engineer of all the engines and boilers in the large fleet of the Peninsular and Oriental Steam Navigation Company, where superheated steam is now and has for some time past been extensively employed, that no difficulty is experienced in its use, and no alteration whatever is required in the old engines beyond the introduction of a slightly better description of packing for the glands, while not a trace of corrosion has been found. It only now remains, therefore, for the manufacturing engineers of this district to bring out a simple and efficient superheating apparatus, adapted to mill engine boilers, by which they will not only benefit themselves, but at the same time render essential service to the steam users of the district. I am glad to say that one of our members is now laying down a superheating apparatus, and, as soon as I have an opportunity of doing so, I shall be happy to state to the members of the association the results of its actual working as applied to the boilers of an ordinary mill engine, and to assist in the general introduction of this system amongst all our members by affording any other information I am able. I would state, however, in the meantime, that it is found most advantageous to superheat the steam to about 100 degrees above the temperature of plain steam, when no difficulty is found in lubricating; also that the utmost care must be taken in maintaining the temperature of the steam when once it has been superheated, or the virtue will be lost before it gets to the engine. I found in one case that although the temperature immediately on leaving the superheater was as high as 600 degrees, yet it had fallen nearly to 300 degrees on its arrival at the engine. I understand that some parties entertain the idea that superheating may be advantageously applied where steam is used for heating purposes. I am convinced, however, that such would not be the case, and that disappointment will inevitably ensue wherever superheating is adopted with this view.

ACADEMIE DES SCIENCES.

ON THE USE OF GLYCERINE IN MARINER'S COMPASSES.

In a recent communication to the "Académie des Sciences," M. Santi observes, that in ships built on the screw principle the compass, by which the helmsman steers, is subject to great vibrations, which are occasioned by the tremulous motion imparted by the screw. This tremulous motion causes the ship to lurch frequently, whereby the steering is obstructed, much time is lost, and a considerable quantity of coal is consequently consumed.

Several attempts have been made in order to obviate these inconveniences. One only has been partially successful, viz., the employment of the compass called by sailors the liquid compass. This instrument consists of two copper basins, one of which enters freely into the other. The outer basin has an inside diameter of about 10 inches, and is about 10 inches in depth. The upper portion is cylindrical; the other portion, which forms the bottom, is shaped like a spherical cup. The other basin is similar to the first, but is of somewhat smaller dimensions, its diameter and its depth being about nine inches. This smaller basin is placed in the larger one, with which it is kept concentric by means of india rubber bands, which unite them together. The space between the two bands is closed by a diaphragm in such a manner that the inside one may move up and down with facility. An opening is made in this diaphragm to admit of the liquid being poured between the basins, the first receiving it internally, and the second externally, so that this last is maintained in a floating position. Compasses constructed on this principle are of great service on board screw ships. The liquids usually employed are sea water, alcoholized water, and liquid tar. The alcohol, from the alcoholized water, soon volatizes, and in addition its density is not sufficient to keep the floating basin steady, and to prevent is vibration—sea-water attacks the copper. Liquid tar, from its density and its comparative immobility, answers the required purpose; but it is objectionable on the score of uncleanliness, and of its want of transparency.

M. Santi uses glycerine, which freezes at 35° below zero cent., and does not volatilize, and its density and comparative immobility are such as to render the effects of the tremulous motion in the compass almost imperceptible.

By adopting glycerine these compasses are rendered transparent and unvarying. The basins are made of crystal instead of copper, and very light spirals of copper are used instead of india rubber bands.

The new transparent liquid compass has superseded the old compass at Marseilles for the last year, and its stability is such that the most violent pitchings of the vessel produce no appreciable effect upon it.

GEOLOGICAL SOCIETY OF LONDON.

November 6, 1851.

"Note on the Bone-Caves of Lunel-Viel, Heralt." By M. Marcel de Serres. Communicated by the President.

"On the Petroleum Springs in North America." By Dr A. Gesner, F.G.S.

After some observations on the antiquity of the use of mineral oil in North America and elsewhere, and on the present condition of the oil and gas-springs, and the associated sulphur and brine-springs in the United States, the author stated that 50,000 gallons of mineral oil are daily raised for home-use and for exportation. The oil-region comprises parts of Lower and Upper Canada, Ohio, Pennsylvania, Kentucky, Virginia, Tennessee, Arkansas, Texas, New

Mexico, and California. It reaches from the 65th to the 128th degree of long. W. of Greenwich, and there are outlying tracts besides.

The oil is said to be derived from Silurian, Devonian, and Carboniferous rocks. In some cases the oil may have originated during the slow and gradual passage of wood into coal, and in its final transformation into anthracite and graphite—the hydrogen and some carbon and oxygen, being disengaged, probably forming hydro carbons, including the oils. In other cases, animal matter may have been the source of the hydrocarbons.

Other native asphalts and petroleums were referred to by the author, who concluded by observing that these products were most probably being continually produced by slow chemical changes in fossiliferous rocks.

"Notice of the Discovery of some additional Land Animals in the Coal-Measures of the South Joggins, Nova Scotia." By Dr J. W. Dawson, F.G.S.

"On a Volcanic Phenomenon observed at Manilla, Philippine Isles." By J. G. Veitch, Esq. In a Letter to Dr J. D. Hooker, F.G.S.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

October 15, 1861.

"On the Irregular Barometric Oscillations at Geneva and on the Great St Bernard, and their Relations to the Mean Temperature and the Fall of Rain." By G. V. Vernon, Esq., F.R.A.S., M.B.M.S.

October, 21, 1861.

The Secretary presented sixty specimens of soundings received since the last Session.

The Secretary read a letter from Mr Joseph Sidebotham, accompanying a specimen and a drawing of the Aulacodiscus formosus, showing the four projecting knobs or handles visible upon that diatom. Mr Sidebotham states that in all drawings hitherto published, these protuberances appear like simple elevations or bosses, nor could they be seen otherwise until the binocular microscope revealed their true shape. Mr Dancer first called his attention to this peculiarity.

Mr Crompton exhibited, and presented to the members, specimens of capillary tubes used by him to collect and preserve fluids for microscopical examination for medical purposes.

The Secretary exhibited a specimen of the compound salt of magnesia and copper, prepared by Mr Thomas Davis, of Warrington.

Mr Lynde exhibited a fine specimen of copper ore, with jasper, from Cornwall, the colours of which, when illuminated with the Lieberkühn, were very gorgeous.

Mr Latham exibited the ovary of a flea, and portions of the skin and teeth of the dogfish.

Mr Heys exhibited specimens, mounted specially for the Lieberkühn, of various seeds, hairs, and glands of plants; the tessellated spines on the Symphytum asperrimum, or rough comfrey, and the ruby coloured oil glands of the Origamme onites, glowing, like precious stones, with the reflected light from above the object, were very much admired. For certain classes of objects no illumination can compare with that of the Lieberkühn in the use of the binocular microscope, and side lights may be obtained, to some extent all around the object, by manipulation with the mirror.

October 29, 1861.

Mr Spence brought before the meeting part of a mass of iron and copper pyrites, containing abundance of large and well defined crystals of pure arsenious acid.

The discovery of these crystals being pure arsenious acid was made by Mr Bottomley, Mr Spence's assistant in his laboratory.

An interesting conversation followed, in which the fact was stated that arsenic is a constituent of nearly all the artificial manures which have superphosphate of lime as their basis; and in connection with this a report was named of arsenic having been found in some of the crops growing with such manures.

Professor Roscoe exhibited the beautiful lithographic map representing the dark lines in a portion of the solar spectrum, lately published by Professor Kirchoff. The lines are printed in ink of six different shades, and are of six different degrees of thickness, so that the leading features of the spectrum can be at once recognised. The position of the bright lines produced by the incandescent vapour of certain metals is also given on the map, and the coincidence of many of these with the dark Frauenhofer's lines rendered evident.

"An Examination into the Products of the Putrefaction of Blood." By Dr Angus R. Smith.

November 12, 1861.

Mr E. W. Binney made some remarks "On the Drift Deposits found near Blackpool."

Dr Joule, in reference to speculations on the thickness of the earth's crust, stated that he had some time ago received a letter from Professor Thomson, giving an account of the progress of investigations calculated to throw light on this interesting subject. Professor Thomson finds that the equilibrium lunar tide in a solid glass globe (without mutual gravitation) of the same size as the earth is about five feet. Hence, from the phenomena of the actual tides of the ocean, it follows that the earth, as a whole, is more rigid than glass. The observations of Mallet, with experimental earthquakes, show that the earth's crust is many times less rigid than glass. Hence Professor Thomson infers that the earth, as a whole, is many times more rigid than the rocks and strata on its surface.

Dr Grace Calvert stated that he wished to draw the attention of the manufacturing chemists of this district to a very simple and rapid method which had been devised by the eminent chemist M. Pelouze, Master of the Paris Mint, for determining the amount of sulphur existing in pyrites. He (Dr Calvert) was induced to do so, believing that any process which would simplify the long and troublesome operations now followed to ascertain the value of this mineral would be useful to many members now present at this meeting. The process consists in mixing intimately together one part of pyrites, thoroughly pulverized in an agate mortar, with five parts of carbonate of soda, seven parts of chlorate of potass, and five parts of chloride of sodium, and placing the whole in an iron spoon, which is gradually carried to a dull red heat. The mass, when cold, is first washed with cold water and then with boiling water, until the whole of the soluble matter is removed; and this solution is tested with a standard solution of sulphuric acid. As 100 grains of carbonate of soda requires 92·45 of monohydrated sulphuric acid, or $SO_3 HO$, it follows that the quantity of soda in the carbonate of soda employed will decrease in proportion to the quantity of sulphur from the pyrites converted into sulphuric acid, which will have neutralised a corresponding quantity of the soda in the carbonate.

This mode of assaying is so simple, that the author states that he can determine, within one or one and a-half per cent., the value of a sample of pyrites, in the space of an hour's time.

M. Pelouze also states that by employing the following proportions of the same materials, the manufacturer can determine the amount of sulphur in burnt pyrites. Five parts of the latter substance are mixed intimately with five parts of pure carbonate of soda and five parts of chlorate of potash.

MONTHLY NOTES.

MARINE MEMORANDA.

New Lighthouse for the Welsh Coast.—At a recent meeting the Mersey Dock Board decided to lease a site, on the great Ormeshead, for a new lighthouse. The cost of the edifice will be £5000, and the annual charge for maintenance £380. Mr J. B. Hartley, C.E., presented a design for the lighthouse.

The Rosario.—This screw steam sloop, 150-horse power, 673 tons, left Sheerness harbour recently, and proceeded to the measured mile for the purpose of testing her speed and machinery. The trial was under the superintendence of Capt. Schomberg, first-class steam reserve. It was attended with very satisfactory results—viz., speed, 9¼; revolutions, 86; pressure of steam, 20; and vacuum, 25. The *Rosario* is fitted with Griffith's screw, the pitch of which is 14, and diameter 10 feet. Her draught of water forward is 12ft. 10in.; aft., 14ft. 2in.

The Leander, late 50-gun sailing vessel, which has recently been lengthened 44 feet amidships in the Sheerness Dockyard, and since fitted with machinery by Messrs Boulton and Watt, left Sheerness recently for Maplin Sands for the purpose of trying her engines at the measured mile. The weather was very rough. As the vessel was commencing her trial at the measured mile, one of the engineers met with a serious accident, which, after the vessel had made two runs, obliged her to return to harbour. So far as the trial went, both ship and machinery answered exceedingly well. The vessel obtained an average speed of 10¾ knots per hour; her revolutions being 52. On her return to the harbour she made 64 revolutions, and worked in a very admirable manner. It is fully believed that she will make 11½ knots per hour at least, which is considered very good for a vessel of only 400-horse power. She is furnished with new patent expansion gear, introduced by Messrs Boulton and Watt. Her working gave every satisfaction. The stokehole was well ventilated, and altogether the trial realised the most sanguine expectations.

The Warrior.—Many interesting results have been obtained from the trial trip of the *Warrior*. In order to try her on every possible point of sailing and steaming, she was matched with the *Revenge*, a 90-gun two-decker, the fastest ship in the Channel Fleet. The weather was upon the whole fair, but the wind was stiff, and at one period rose almost to the dimensions of a gale. A letter of the 7th, from Queenstown, says:—You will be pleased to hear that the *Warrior*, under steam, has been what may be considered a complete success. Under sail and steam she went 16·3 knots, and coming into this place on Tuesday from off Cape Clear, at the time the *Revenge* was going about 13 knots, she was going 15·2; the *Revenge* under a considerable press of sail and full steam; the *Warrior* topsails and foresail, and full steam. Steaming head to wind and sea, the *Warrior* went 9·8 at a time when the *Revenge*, at the rendezvous, found it necessary to take in the third reef of her topsails. The trials in sailing have not been very favourable to the *Warrior*. The first day, by the wind, the *Revenge's* jibboom went just before starting; but afterwards, on starting, the *Warrior* settled gradually to leeward. The next day the trial was with the wind abeam, when the *Revenge* left the *Warrior* very much, the *Warrior* having a reef out of the topsails, royals, and foretopmast studdingsail more than the *Revenge*. By the *Warrior's* own account, the *Revenge* left her at the rate of 500 yards per hour. The *Revenge* hardly works fair with the *Warrior* in steaming. The *Warrior's* fuel is the best Welsh coal, and fresh, while that of the *Revenge* has been in the ship a long time. The stokers and engineers of the *Warrior* are very numerous compared with those of the *Revenge*; but the *Revenge's* stokehole is vastly superior to the *Warrior's*.

The Warrior.—The *Warrior*, 40, screw, Capt. the Hon. A. A. Cochrane, C.B., recently made her trial of speed with reduced power at the measured mile, in Stokes Bay, in charge of Capt. Broadhead, commanding the reserve at the port. Mr Miller, of the factory department, and Mr Murdoch, inspector of machinery afloat, superintended the working of the machinery and other details of the trial. The weather was as favourable as could be wished for the occasion. Four runs were first made over the trial ground with six boilers (the ship at full power uses 10), and the following results were obtained:—First Run.—Pressure of steam, 2 lb; vacuum, forward engine, 26½; after do., 26½; revolutions of engines, 43; speed in knots, 13·483. Second Run.—Pressure of steam, 20 lb.; vacuum, forward engine, 26; after do., 26; revolutions of engines, 44; speed in knots, 11·043. Third Run.—Pressure of steam, 18½ lb.; vacuum, forward engine, 27; after do., 26; revolutions of engines, 43; speed in knots, 13·235. Fourth Run.—Pressure of steam, 20 lb.; vacuum, forward engine, 27; after do., 25; revolutions of engines, 44; speed in knots, 11·077. The mean speed of the four runs in knots was 12·186. Two runs were next made with four boilers as follows:—First Run.—Pressure of steam, 20 lb., vacuum, forward engine, 27; after engine, 28; revolutions of engines, 37½; speed in knots, 12·080. Second Run.—Pressure of steam and vacuum the same as in the preceding run; revolutions of engines, 38; speed in knots, 10·000; mean of the two runs, 11·040. Temperature, engine-room.—Max., 92; min., 85. Temperature, stokehole.—Max., 113; min., 98. The indicator cards showed favourably.

The Royal Oak.—By direction of the Comptroller of the Navy, acting under the instructions of the Admiralty, a modification is to be made in the construction of the stern portion of the *Royal Oak*, 50, iron-plated frigate, building at Chatham, by doing away with the aperture, or screw well, at the stern of the frigate for raising the screw when not required in steaming. This will add considerably to the strength of the vessel, as the opening between the rudder post and stern will be filled up, with the exception of the space for the working of the screw. By the adoption of this principle any defects in the screw can only be remedied on the steamer reaching the harbour. The Admiralty have also under their consideration a suggestion for the adoption of headless rudders and some other improvements which are likely to be used in the construction of this class of frigate. The armour plates which will protect the exterior of the *Royal Oak* are not to be tongued and grooved, but are to be of an uniform thickness throughout, experiments having shown that grooved iron plates present less resistance to shot than the plain plates. A number of the new description of armour-plates were landed recently at the dockyard. They are of immense weight and substance, each plate being 16 feet in length by 3 feet 3 inches in breadth, and 4½ inches in thickness, while the weight varies from 79 cwt to 82 cwt each. Instead of being forged, the plates are all rolled, the Admiralty having entered into a contract with the Parkgate Iron Company, Yorkshire, where powerful machinery for manufacturing them has been erected. The *Royal Oak* is now completely framed. Every effort is being made to hasten forward her construction, for which purpose there are nearly 300 shipwrights, caulkers, and labourers employed on her. The alterations ordered to be effected in the *Royal Oak* are to be adapted in the *Royal Alfred*, the *Ocean*, and the *Caledonia*, 50-gun iron-plated frigates, under construction at the other Royal dockyards.

Important Lifeboat Services.—During the fearful gales of the 2nd and 13th inst., the lifeboats of the National Lifeboat Institution have been providentially the means of rescuing the following numerous shipwrecked crews from an inevitable and appalling death:—Luggar *Saucy Lass*, of Lowestoft, 11; schooner *Fly*, of Whitby, saved vessel and crew of 4 hands; smack *Adventure*, of Harwich, 10; pilot cutter *Whim*, of Lowestoft, 7; barque *Undaunted*, of Aberdeen, 11; brig *Lively*, of Clay, Norfolk, 5; barque *Robert Watson*, of Sunderland, 5; schooner *Auchincruive*, of Grangemouth, 6; and schooner *Friends*, of Lynn, 4; total, 63. Making an aggregate total of *Two hundred and seventy* persons rescued from a watery grave by the lifeboats of the Institution during the present year *alone*. It is gratifying to know that the whole cost of some of these lifeboats, which have thus rendered such important service to the cause of humanity, was presented by benevolent persons to the Society. The National Lifeboat Institution has now a fleet of nearly one hundred and twenty lifeboats under its management, which require a large and increasing amount to keep them in a state of efficiency and ready for instantaneous use, either by day or night. To man these lifeboats there has arisen a race of heroes—iron men whom no danger daunts, whom no storm deters from a vocation scarcely less sacred than that of the priest,—the task of saving human life. The Royal National Lifeboat Institution is one of the glories of Britain. Looking at it we can say to every foreign potentate, "Go thou and do likewise." The charity which is shown in the bestowal of one craft, is a charity that is visible and is felt. It is a substantial investment in the Bank of Mercy, in which the dividends are sure. It goes to swell no secretary's salary, to fatten no collector with fees. The good Samaritan left twopence at the inn for the man who had fallen among thieves, and *knew* that he would have substantial relief; the English Samaritan, who gives two hundred pounds, can see the barque built by his munificence launched amidst cheers of hardy mariners—can see her battling unconquered with the waves—can see her reach the sinking ship—can see her gallant crew rescue the despairing wretches who cling with blue hands, and with briny death at their very mouths, to broken pieces of the wreck.

A new plan for an auxiliary and reserve rudder, invented by Mr W. R. Mulley, has just been exhibited at Lloyd's, where it seems to have met general approval. It is about half the superficial area of the main rudder, oblong shaped, and formed of separate bars of copper or iron, in such manner as will allow it to twist (its action resembling that of the fin of a fish) in and out of the quarter where it is hung at an optional depth below the water line, and when not in use recessed so as to take the shape of the bottom, leaving no projection whatever. The inventor points out that for ships of war it affords especial advantages, since it would enable the iron-cased batteries to tread their way through narrow and intricate channels that with their present means of steering they would not attempt, while in such ships as the *Warrior* it would not only greatly facilitate their powers of manœuvring, but serve as a reliable resource in the event of the main one being shot away, a casualty much to be feared now that rifled cannon will be used with such precision, the auxiliary itself being secure and out of harm's way.

There are 54 ships of war now under construction at the Royal Dock and other private yards, many of which are in a very forward state for launching. This return, which has been carefully compiled, will show that these vessels will carry an aggregate of 1254 guns, are of 10,930 horse power, and 95,255 tons. The names of these vessels, together with the place of building, are as follows:—

Ships.	Guns.	Horse-power.	Tons.	Port.
Achilles,	50	1250	6079	Chatham.
Africa,	11	150	669	Devonport.
Alligator,	22	400	1857	Woolwich.
Belvidera,	51	600	3027	Chatham.
Bramble,	2	60	236	Portsmouth.
Bruiser,	2	60	236	Portsmouth.
Bulwark,	89	800	3716	Chatham.
Caledonian,	50	800	4045	Woolwich.
Cherub,	2	60	236	Portsmouth.
Columbine,	11	150	669	Deptford.
Cromer,	2	60	236	Portsmouth.
Crown,	2	60	236	Portsmouth.
Dartmouth,	36	500	2478	Woolwich.
Dromedary,	—	100	400	Millwall.
Dryad,	51	600	3027	Portsmouth.
Endymion,	36	500	2478	Deptford.
Enterprise,	11	150	669	Deptford.
Favourite,	22	400	1623	Deptford.
Guernsey,	4	200	695	Pembroke.
Harlequin,	17	200	950	Portsmouth.
Hector,	32	800	4063	Glasgow
Helicon,	—	250	835	Portsmouth.
Ister,	36	500	3027	Devonport.
Jaseur,	5	80	425	Deptford.
Menai,	22	400	1857	Chatham.
Minstrel,	2	60	233	Portsmouth.
Myrmidon,	4	200	695	Chatham.
Nassau,	4	200	695	Pembroke.
Netley,	2	60	233	Portsmouth.
Newport,	5	80	425	Pembroke.
North Star,	22	400	1623	Sheerness.
Ocean,	50	1000	4045	Devonport.
Orontes,	—	500	2812	Blackwall.
Orwell,	2	60	233	Portsmouth.
Protector,	2	60	233	Portsmouth.
Rattler,	17	200	951	Deptford.
Reindeer,	17	200	951	Chatham.
Repulse,	89	800	3716	Woolwich.
Robust,	89	800	3716	Devonport.
Royal Albert,	50	800	3716	Portsmouth.
Royalist,	11	150	669	Devonport.
Royal Oak,	50	1000	3716	Chatham.
Salamis,	—	250	835	Chatham.
Sappho,	17	200	950	Deptford.
Shearwater,	11	150	669	Pembroke.
Sylvia,	4	200	695	Woolwich.
Tamar,	—	500	2812	Millwall.
Tartarus,	4	200	695	Pembroke.
Triumph,	50	800	3716	Pembroke.
Tweed,	51	600	3027	Pembroke.
Tyrian,	2	60	233	Newhaven.
Valiant,	32	800	4063	Millwall.
Wolverene,	21	400	1623	Woolwich.
Zealous,	89	800	3716	Pembroke.
Total,	1254	10,930	95,255	

Atlantic and Great Western.—The traffic receipts on this company's line for the week ending the 15th of October amounted for passengers to 515 dols., for merchandise to 3108 dols., for express to 82 dols., and for mails to 56 dols.—total, 3761 dols.

East Indian.—The traffic receipts for the week ending the 28th of July on 248 miles of the Bengal division of this company's line amounted to £5581, against £3208 on 166 miles in the corresponding week of last year. The traffic receipts for the week ending the 4th of August amounted to £5371, against £3644 for the corresponding week of 1860.

Railway Traffic.—The traffic receipts of railways in the United Kingdom for the week ending the 2d of November amounted to £540,945, and for the corresponding week of last year to £537,530, showing an increase of £3415. The gross receipts of the eight railways having their termini in the metropolis amounted to £248,412, and for the corresponding week of 1860 to £247,108, showing an increase of £1304. The increase on the Eastern Counties Railway amounted to £1847; on the Great Northern, to £2199; on the Great Western, to £635; and on the London and South-Western, to £1027—total, £5708. But from this must be deducted £1528, the decrease on the London and North-Western, £134 on the London and Blackwall, £447 on the London, Brighton, and South Coast, and £2295 on the South-Eastern, together £4404, leaving the increase, as above, £1304. The receipts on the other lines in the United Kingdom amounted to £292,533, and for the corresponding period of last year to £290,422, showing an increase of £2111, which, added to the increase on the metropolitan lines, makes the total increase £3415 as compared with the corresponding week of 1860.

Death of Sir Howard Douglas.—We regret to announce the death of General Sir Howard Douglas, Bart., G.C.B., in the 85th year of his age, having been born in 1776. His career, military, political, and scientific, had been both long and distinguished. He entered the army in early life, served in Portugal and Spain in 1808 and 1809, formed part of the expedition to Walcheren in the following year, returned to the Peninsula in 1811, and served there until the close of the campaign of 1812. He was Governor of New Brunswick from 1823 to 1829, was Lord High Commissioner of the Ionian Islands from 1835 to 1840, represented Liverpool from 1835 to 1847, and was the author of many scientific treatises, especially on fortification and gunnery—a subject which occupied his attention until the very close of his long and active life. Sir Howard contributed largely to the scientific press;—our readers will probably remember his book "On Naval Warfare by Steam,"—reviewed by us in the pages of the *P. M. Journal.*

The Exhaustibility of Artesian Wells.—The question as to the lasting or failure of the supply of water from wells on the Artesian principle, has been often asked, and our own reply has always been that, in situations and under conditions at all favourable to their use, water will never cease to flow from them. Our opinion is now confirmed in a practical manner by M. Gaudin, the French engineer. With reference to Paris, the stratum of green sandstone interposed between the strata of chalk and Jurassic limestone is of the average thickness of 164 feet; consequently, taking the depth of 1,892½ feet of the Artesian well at Passy as a criterion, there remains a depth of 82 feet of sand. A cubic metre of sand, closely rammed, weighs 1,600 kilogrammes, while compact quartz weighs 2,500 kilogrammes; hence the stratum of sand, even supposing it to be closely packed, has interstices amounting to one-third of its bulk in the aggregate, so that every cubic metre (35½ cubic feet) of sand under water contains 333 litres (73¼ gallons) of water. Now, the layer of sand existing under the chalk may be represented by a disc of 100 miles radius, and its thickness to 26 feet. The cubic contents of this disc are, therefore, 141,312,500,000,000 gallons, which, divided by 22,060,000,000, then by 365, gives the quotient 175, being the number of years requisite to exhaust the supply of water at the rate of 10,000,000 cubic metres (22,060,000,000 gallons) per day! This would be correct supposing the quantity of water to remain stationary, and never to receive any increment by the infiltration of rainwater and that of rivers. But as their sources yield half a metre a year, the annual increase of the water, is double that expended, so that the wells in the neighbourhood of Paris, at any rate, will never be exhausted. Now that boring is so much better understood than formerly, it appears to us that the Artesian system will rapidly work its way into modern favour. The Passy well, nearly 2000 feet deep, has answered well, even at the great cost which the imperfect French system has necessarily entailed. Messrs Mather, of Manchester, executed an 18-inch bore to a depth of 550 feet into the chalk at Messrs Hall & Boyd's sugar works, London, half a dozen years ago, and an abundant supply has been obtained. The bore at the Plumstead Water Works is by the same engineer, and an immense supply of water is there obtained from the chalk fissures only. A well at Norwich, now being bored, has attained a depth of more than 1,500 feet, the diameter being 18 inches. This work proves the superiority of the modern "rope" system of boring, as a depth of 46 feet was there obtained in 24 hours, with only two men at work. With this system, in boring through the running sands at Birmingham, ten tons per hour were brought to the surface, the bore being 67 feet deep, and the diameter 27 inches. Bores of 18 inches may be sunk in London at L.1 per foot, so that a London well may be executed for L.3,000.

Steam Machinery of the Farm.—Mr Aveling, of Rochester, so well known for his assiduous endeavours towards the introduction of steam machinery for the farm, appears to have never lost sight of the great principle for which he "went in." At the recent show of the Nonington and Wingham Agricultural Association in Kent, he was by far the largest exhibitor of the farmer's mechanical assistants—the whole of what he presented, being brought to the show ground by one of his patent agricultural locomotive engines—this engine was similar to the one for which he has lately obtained a prize gold medal. In the engine formerly made by Mr Aveling the cylinder was placed over the fire-box; it is now placed in the smoke-box, and is surrounded by a steam jacket. The heavy fly-wheel, is brought forward over the driving-wheels, upon which indeed the whole weight is nearly balanced. There is also a steam dome fixed over the fire-box. With these improvements there is no incline on common roads these engines cannot ascend. The steering apparatus has been improved also. Instead of the clumsy wooden shafts, angle-iron has been substituted. This steerage perfectly controls the course of the engine, even when turning at right angles and with a train of machinery behind. The driving wheels have rims twelve inches broad, but only take that bearing when running on soft ground. A tyre four inches wide is situated in the middle of the width of each rim, and on firm ground the engine runs on these tyres only. The engine can travel across a ploughed field or a bad road, by the ready adjustment of five angle iron paddles or clips across the rim of each driving wheel. The engine made a journey from Rochester to Nonington, a distance of 40 miles, under steam, bringing with it a double blast thrashing machine, with the new patent corn elevator. The grain, instead of being elevated by the ordinary tin cups, is raised by the blast from a fan, which also dresses the corn in its passage to the separating screen, thereby obviating the necessity for a second blower, and greatly simplifies the machine, inasmuch as four of the ordinary straps, eight pulleys, and sixteen bearings are dispensed with, thereby economising wear and tear to a considerable extent. There was also in the train a truck load of machinery, and behind this two Suffolk drills, and a clod crusher, &c. The length of the train was upwards of one hundred feet, and the weight more than twenty tons, which the engine propelled up the steep hills and round sharp turns with the greatest ease, a practical proof of the successful application of steam power to these purposes. Mr Aveling has already got 34 of his engines at work, and working well.

The Silicious Treatment of Stone.—How often have we cause to lament that all our easily workable building stones are subject to such rapid decay. Even our most modern structures bear lamentable evidence of this unfortunate fact, and it is pitiable to see our choicest ornate details, exfoliating everywhere in laminæ, and gradually crumbling away. The memorable instances of our Houses of Parliament, so lavishly covered with admirably sculptured decoration as they are, alone present a sufficient case for the fullest investigation of the subject with the view of arresting this continually increasing evil. Everything yet tried as a remedy points out that silica must form the basis of whatever preservative ingredient may hereafter be fixed upon. If we can only manage to cause a sufficient quantity of silica to enter and entirely fill up the pores of the stone, and encrust all the exposed surfaces—the silica being applied in such a form as to gradually combine with the earthy constituents of the stone, whilst its action is uninterfered with by saline impurities—if we say we can do this, we have strong reason for the presumption that we may be enabled to present a stone which will bid defiance to all the ill which the atmosphere can effect. It is quite easy to obtain silica in the form of a pure aqueous solution, and as a suggestion for the consideration of all who may wish to open up the wide field of inquiry still before us, we give the following ascertained means of accomplishing what is required:—1. By dissolving sulphide of silicium in water, when sulphuretted hydrogen is given off, and the silica remains completely dissolved and in such quantity that the liquid gelatinises when an attempt is made to evaporate it. 2. By precipitating silica in the gelatinous state from an alkaline silicate, by means of acetic or other weak acid, and, after well washing, heating it for some time under pressure, with a small quantity of water in a closed vessel. A liquid is thus obtained which gelatinises on addition of a saline solution. 3. By passing gaseous fluoride of silicium over crystallised boracic acid, and separating the hydrofluoric and boracic acids by digestion with a large excess of ammonia, a hydrate of silica remains, which, when well washed from the above acids, is very soluble in water. This solution gives no precipitate when boiled, but leaves silica as an insoluble powder on evaporation. 4. By the beautiful mode recently pointed out by Professor Graham, in which advantage is taken of the new means of separating bodies by dialysis. A solution of silicate of soda, supersaturated with hydrochloric acid, is placed on one side of a parchment paper septum, pure water being on the other side; in a few days the hydrochloric acid and chloride of sodium will be found to have completely passed through the diaphragm, leaving the silica in aqueous solution, and so pure that acid nitrate of silver fails to detect chlorine in the liquid. This solution remains fluid for some days, but it ultimately gelatinises. When a pure aqueous solution of silicic acid prepared as above is allowed to soak into the pores of chalk or dolomite, a process of hardening rapidly occurs, which goes on increasing for several days, whilst, owing to its considerable depth of penetration, and to there being no soluble or efflorescent compounds to be removed, there is every probability that this hard silicious impregnation will afford permanent protection to the stone. We have reason to know that active investigations are now going on in various quarters with reference to the use of such solutions as we have described, and to the result of these we are at present looking with considerable interest.

Hull, founded in 1296, commenced engineering operations in 1767, when the town was surrounded by military works and ditches, with only the river Hull, as a harbour for vessels, and there being then only a population of 13,000. The construction of the Junction, the Humber, and the Prince's Dock form the next part of history—the period between the opening of the Humber Dock in 1809 and the Prince's Dock in 1859, producing the application of steam as a propelling power to vessels, causing such a revolution in maritime affairs that its effects would not be checked until every department had been affected by it. Hull was the very first port to apply this new and wonderful power, and it has gone on increasing in importance in its river, coasting, and foreign trade, requiring continually increased accommodation for its splendid fleet of steamers and other shipping. Messrs Brownlow, Lumsden, and Co., Messrs C. W. Earle and Co., and Messrs M. Samuelson and Co. have within the last 10 or 12 years built no fewer than 124 large steamers, the greater number of which were vessels of about 3000 tons burden, and for strength and finish scarcely to be excelled. Indeed, the capabilities of Messrs Earle and Messrs Samuelson for steamship building were very great, both having built very large and powerful ships in a very short space of time; and it may be said that for complete appliances and extent of building ground there are few establishments in Great Britain to be compared with, and better adapted for shipbuilding purposes than Messrs Samuelson and Co.'s. Their yard, consisting of nearly nine acres, has the advantage of two extensive river frontages, the one to that of the river Hull of 900ft. and the other to that of the Humber, of upwards of 800ft. In addition to a vast amount of machinery for shipbuilding, they have nearly completed the construction of two powerful hydraulic slips, for the purpose of taking up ships of the largest burden for repairs. There exist at the present time, belonging to the Dock Company, 42a. 1r. 15p. of dock water area, 6a. 2r. 3p. tidal basins, 24a. wharfage area, and 16,450 lineal feet of quayage, or berths for ships. The New Western Dock, for which an Act was obtained last Session, will contain 17 acres of water space, 4 acres 21 poles tidal basins, 24 acres of wharfage, and 9060 lineal feet of quayage. The port will thus possess when the new dock is completed, 87½ acres of dock and tidal water space, 48 acres of wharfage, and 33,335 lineal feet of quayage. The tonnage of the port in 1775 amounted to 109,491; in 1860, to 1,215,203—showing an increase of tonnage in 85 years of 1,105,712 tons, which being taken as a basis for the future, Hull might with confidence anticipate an increase in a more rapid ratio, and, instead of 87½ acres of dock space satisfying the growing demands of commerce, double that quantity would be required before the lapse of the next 85 years. When the port is considered in reference to its situation, as connected with all the great manufacturing towns of England, its site on the grand old estuary of the Humber, having full access to and from the sea without obstruction at all times and states of tide, its position in reference to all parts of Northern Europe, what port can legitimately become its successful rival on the east coast of England?

Artesian Well at Passy.—The idea of boring this well originated with the necessity of providing pure and wholesome water for the population of Paris, which in a short time had increased from 1,200,000 to 1,700,000; thus materially augmenting the causes of infection to which the waters of the Seine are necessarily subject. Paris rests upon a stratum of chalk, about 500 metres in depth, covered with about 50 metres of various strata of tertiary soil, and itself resting on nearly 50 metres of marl or clay, which is in contact with the green sands from which the well of Grenelle derives its supply. The successful boring of the latter had established the fact that the water which these sands received from localities at a distance from Paris might be made to rise to the surface, and even to 30 or 40 metres above. But the experiment had only been tried for bores not exceeding a diameter of from 20 to 30 centimetres, yielding a supply of from 2000 to 4000 cubic metres of water per day. M. Kind came forward with an offer to bore a well of a diameter of 60 centimetres, yielding 13,300 cubic metres at an altitude of 25 metres above the highest point of the Bois de Boulogne. Though limiting his promises to the yield above stated, he declared his conviction that it would reach 39,600 metres, an assertion which most engineers considered exaggerated, deeming it highly improbable that an increase in the diameter would increase the supply. On the 23d of Dec., 1854, the works were resolved on, and the spot chosen in the neighbourhood of the Bois de Boulogne, where the high temperature of the expected column of water might be turned to account. But the enterprise was fraught with difficulties which it required the unflinching perseverance of M. Kind to overcome, although, out of the 587½ metres which constitute the depth of the new well, there were scarcely 30 offering any serious obstacle, and these were situated in the clay either above or below the chalk stratum. On March, 31, 1857, the bore had already reached 528 metres, and water was hourly expected, when suddenly the tube of sheet iron which supported the clay was crushed by its pressure at a depth of only 30 metres from the top. This accident it took nearly 3 years to repair; a shaft of the depth of 53½ metres had to be dug close to the bore, through all the most dangerous strata, and lined partly with sheet, and partly with cast-iron and masonry. Its diameter was three metres throughout the two-thirds of its depth, and 1·70 for the rest. It was a work of extreme difficulty. Cast-iron tubes, of the thickness of 35 millimetres (four-fifths of an inch), were starred or cracked in all directions, as if they were mere glass. More than once the workmen refused to risk their lives in this work, and the city engineers had to set the example of personal courage. This stupendous labour was not brought to an end before the 13th of December, 1859. The old orifice was then cleared, and the boring recommenced, and continued without any further accident to the depth of 550 metres, when the tube, composed of wood strongly hooped with iron, and ending in a bronze pipe, two metres of which were fitted into the wood, the remaining 12 metres being free, stuck fast in such a way as to render all further progress nearly hopeless. However, M. Elie de Beaumont having, upon a mature examination of the specimens brought up by the borer, declared water to be close at hand, it was resolved that the bore should be continued with a small diameter, to be afterwards enlarged, if necessary. Water was found for the first time at 577½ metres, but it remained a few metres below the level of the orifice. A second tube, of sheet-iron, 70 centimetres in diameter, 2 in thickness, and 52 metres in length, 12 of which were loopholed in order to let the water pass, was sunk and soon stopped in the clay. The boring was now resumed to attain the largest diameter, until the 24th of September last, when M. Kind saw not only his promise fulfilled, but even his hopes, to a certain extent, realised. The bronze tube has remained where it was, but the concentric one of sheet-iron has sunk to 380 metres. M. Michal, Inspector-General of the Works of the City, has arranged in a table the relative variations experienced up to the 2d inst. in the yield of the two wells of Passy and Grenelle; but on this score we have a later account, stating that the decrease in the latter does not exceed one-fourth of its yield prior to the 25th ult. On the 2d inst. that of the well at Passy was 20,000 cubic metres in 24 hours. M. Dumas attributes the diminution of the yield at Grenelle to a diminution of pressure, and is inclined to believe that when the tube at Passy shall have been brought to its normal altitude of 78 metres above the level of the sea the yield at Grenelle will again rise to its former figure, or nearly so. M. Elie de Beaumont has ascertained that the strata traversed at Passy are nearly the same as those met with at Grenelle. As to the chemical nature of the water at Passy, it seems, until further analysis, to be nearly the same as that of Grenelle; the temperature is also the same, viz., 28 degrees centigrade. Whether other wells may be bored elsewhere in Paris without injury to the two existing ones is a question which experience alone can decide. The well at Passy has cost nearly 1,000,000f., and will yield water sufficient for the wants of 500,000 inhabitants.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

15*th October*, 1861.

2569. William E. Newton, Chancery Lane—Improvements in the condensers and condensing apparatus of steam engines.—(Communication from Francis B. Stevens, Weehawken, New Jersey, U.S.)

2570. Richard A. Brooman, Fleet Street—Improvements in propelling ships and vessels.—(Communication from Charles A. S. Victor, Paris.)

16*th October*, 1861.

2571. John Dixon and Robert Clayton, Bradford, Yorkshire—Improvements in the construction of railway wheels.

2572. Richard A. Brooman, Fleet Street—An improvement in plates.—(Communication from Victor A. Marcelin, Paris.)

2573. Francis B. Baker, Sherwood Street, Nottinghamshire—Improvements in dressing or stiffening lace and other fabrics.

2574. Thomas Forster, Sparrow Hall, Streatham, Surrey—Improvements in reworking waste vulcanised india-rubber.

2575. John J. Adams, New York, U.S.—A new and useful improvement in the manufacture of flexible hack brushes for cleaning and dusting horses and other animals.

2576. Alfred V. Newton, Chancery Lane—Improvements in the construction of grain and grass harvesters.—(Communication from Edwin P. Russell and Porter Tremain, Manlins, Onondaga, New York, U.S.)

2577. William Biddell, Birmingham, Warwickshire—Improvements in the manufacture of shot.

2578. William Clark, Chancery Lane—Improvements in the means or apparatus for closing and securing mail bags and other packages.—(Communication from Jean R. Bonbilla, Boulevart St. Martin, Paris.)

2579. Joseph Lister and David Myers, Caledonian Street, Bradford, Yorkshire—Improvements in lifting or hoisting apparatus, whereby to ensure the safety of the cage or article lifted when a rope or chain breaks or is overwound, and in hoists generally as applied to mills, warehouses, and other buildings.

17*th October*, 1861.

2580. William Smith, Salisbury Street, Adelphi—Improvements in the apparatus for and method of increasing the illuminating power of gas.—(Communication from Hugo Carstanjeu, Cologne.)

2581. Reuben Hayes, Manchester, Lancashire—Improvements in gun and ammunition carriages.

2582. Louis A. J. Deplanque, High Street, Borough—Improvements in the machino to decorticate corn and seeds.

2583. William T. Weston, Trafalgar Square—Improvements in screw wrenches.

2584. William Welch, King Street, Southsea, Portsmouth, Hants—Improvements in marine screw propellers.

2585. Robert Smith, Higher Chatham Street, Chorlton upon Medlock, John B. Rowcliffe, Manchester, Lancashire—Improvements in apparatus for winding yarn or threads on the pin-bobbins or spools used in smallware and ribbon looms.

2586. Charles de Groote, Brussels, Belgium—An improved instrument for corking bottles and other vessels.

2587. John Tattersall, Preston, Lancashire—Improvements in the construction of carding engines used in the preparation of cotton and other fibrous substances for spinning.

2588. Thomas Wild and Thomas Hodson, Heywood, Lancashire—Certain improvements in the method of heating the feed water for steam boilers, and in employing steam produced by such means.

2589. Thomas E. Merritt, Rochester, Kent—Improvements in apparatus for obtaining motive power.

2590. Robert Aytoun, Edinburgh, Mid-Lothian—Improvements in apparatus to be applied to chimneys or flues for improving the draught therein, and for preventing down draughts or the descent of smoke into apartments.

18*th October*, 1861.

2591. William Croome, Kilmersdon, Radstock, near Bath, Somersetshire—Improvements in lamps.

2592. Henry J. Distin, Great Newport Street, Leicester Square—Improvements in metal musical wind instruments.

2593. John Crosthwaite and Thomas E. Arman, Liverpool, Lancashire—An improved swivel target and signal apparatus to be used with the same.

2594. John Goucher, Worksop, Nottinghamshire—Improvements in the beaters and drums used in thrashing machines.

2595. Edward Peyton, Birmingham, Warwickshire—Improvements in the frames of metal bedsteads.

2596. James Lawson and Henry Carter, Woolwich, Kent—Improvements in metal musical instruments.

2597. Charles D. Abel, Southampton Buildings, Chancery Lane—Improvements in apparatus for the simultaneous manufacture of white lead and vinegar.—(Communication from Robert Rowland, New York, U.S.)

2598. Charles H. Holt, Huddersfield, Yorkshire—Improvements in steam engines and boilers and in apparatus connected therewith, part of which improvements is also applicable to raising and measuring fluids generally.

2599. William Streather, Rannds, Northamptonshire—Improvements in the construction of wind engines and in the structure containing the same, parts of which are applicable in the construction of windmills.

2600. William Sadler, Tredegar Place, Bow Road—Improvements in armour plated ships.

2601. Patrick Robertson, Sun Court, Cornhill—Improvements in the manufacture of cartridges.—(Communication from Algemon Johnston, Middleton, Connecticut, and Lorenzo Dow, Topeka, Kansas, U.S.)

2602. Benjamin Taylor, Birmingham, Warwickshire—An improvement or improvements in the manufacture of certain descriptions of brace webs.

2603. Thomas W. Cowan, Greenwich, Kent—Improvements in the construction of breech-loading ordnance.

2604. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in braiding machines.—(Communication from Thomas J. Sloau, Paris.)

2605. Hugh Maemeikan, Stratford, Essex—Improvements in smelting copper, gold, and other ores.—(Communication from Roland V. Rodda, Alberton, near Adelaide, South Australia.)

2606. Charles Cheyne, Great George Street, Westminster, and Thomas B. Moseley, Lewisham, Kent—Improvements in the construction of apparatus for signalling on railways, by which improvements the signalling apparatus is rendered self-registering or recording, and also applicable for measuring and recording the speed of passing trains and the time of their passage, part of which improvements is applicable for recording the speed of trains where signalling is not required.

19*th October*, 1861.

2607. James Webster, Birmingham, Warwickshire—Improvements in manufacturing oxygen gas and obtaining certain other products.

2608. Walter G. C. Hudson, Milk Street, Cheapside—Copying letters and other written papers or documents.

2609. Robert Mushet, Coleford, Gloucestershire—A new or improved manufacture of titanic pig metal or alloy of titanium and iron.

2610. Théophile Lepeinteur, Paris—Improvements in fastenings for gloves, belts, and other articles.

2611. Thomas Fearnley, Arcadia Street, Manningham, near Bradford, Yorkshire—Improvements in steam hammers.

2612. James Cooper, Hightown, near Leeds, Yorkshire—Improvements in carding engines for the carding of cotton, silk, wool, and other fibrous substances.

2613. John Marshall, Savile Row, St. James', Westminster—The collection, concentration, and transmission of sound, so as to facilitate the hearing thereof.

2614. James Bourne, Oakamoor, Staffordshire, and Edward Kidd, Birmingham, Warwickshire—Improved machinery for the manufacture of tubes and cylinders, which is also applicable to other useful purposes.

2615. John Wainwright, Connaught Place West—Improvements in ventilating rooms and buildings.

2616. Charles de Bergue, Dowgate Hill—Improvements in sleeper chairs for the permanent way of railways.

2617. William C. Cambridge, Bristol—An improvement in the construction of harrows.

2618. Frederick J. Evans, Horseferry Road, Westminster—An improved mode of and apparatus for carburetting gases for the purpose of illumination.

2619. Henry Bloxam, jr., Shrewsbury, Salop—Improvements in sights for rifles and ordnance.

21st October, 1861.

2620. Henry Lamplough, Holborn Hill—Improvements in the means for igniting the wicks of candles and lamp wicks.

2621. Colin M'Dougall, Manchester, Lancashire—Improvements in connecting and fastening the bands of covered steel or other materials used for crinolines.

2622. John Smith, Bradford, Yorkshire—Improvement in machinery or apparatus for combing cotton or other fibrous substances.

2623. Josiah T. Smith, Barrow-in-Furness, Lancashire—An improvement or improvements in collecting the inflammable gases evolved from blast furnaces.

2624. Edward Oldfield, Salford, Lancashire—Improvements in self-acting mules for spinning and doubling.

2625. Francis A. Calvert, Manchester—A new engine to be propelled by compressed atmospheric air or steam.

2626. Joseph S. Phillips, College Mount, Finchley Road—A new method and apparatus for the propulsion of vessels through the water.

2627. William E. Gedge, Wellington Street, Strand—Improvements in the manufacture of flannel.—(Communication from Jean P. Manichon, jr., Reims, France.)

2628. Ferrar Fenton, Fishguard, Pembrokeshire—Improvements in obtaining and treating fibrous substances.

2629. William Winniatt, Bristol, Somersetshire—Improvements in machines for kneading dough.

2630. Nicholas D. P. Maillard, Dublin—Improvements in ploughs.

2631. John Toward, Newcastle-upon-Tyne—Improvements in machinery or apparatus for bending iron.

2632. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in apparatus for facilitating the passage of trains up steep gradients on railways.—(Communication from Thomas Agudio, Turin, Italy.)

2633. John Toward, Newcastle-upon-Tyne—Improvements in armour plates for ships, and in securing the same to the sides of a vessel.

2634. William Connell, Sewardstone Mills, Essex—Improvements in machinery or apparatus for washing fabrics, yarns, wool, clothes, and other similar articles.

22d October, 1861.

2635. Herbert Frost, Manchester—Improvements in apparatus for measuring fluids.

2636. George England, New Cross, Surrey—Improvements in planing machines.

2637. Robert Mushet, Coleford, Gloucestershire—An improvement or improvements in the manufacture of a certain metallic alloy.

2638. Frederick O. Ward, Hertford Street, Mayfair—Improvements in hydraulic presses and in the machinery and apparatus appertaining thereto and requisite in working the same, part of such improvements relating to the pumping machinery attached to hydraulic presses, and this part being applicable to pumping machinery employed for other purposes.

2639. Henry May, Tewkesbury, Gloucestershire—Improvements in goloshes.

2640. Howard B. Fox, Liverpool, Lancashire—Improvements applicable to iron and other metallic bedsteads.

2641. Richard A. Brooman, Fleet Street—Improvements in reaping machines.—(Communication from Cyrus H. M'Cormick, Chicago, U.S.)

23d October, 1861.

2642. George Archer, Raunds, Northamptonshire—Improvements in sewing boots and shoes.

2643. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in separating or extracting silver from lead.—(Communication from Jules F. de la Batie, Paris.)

2644. Alfred Bevan, Gravesend—Improvements in the construction of iron vessels and iron plated ships of war.

2645. Samuel Young, Belfast, Antrim—Improvements in the spindles and flyers of machinery employed for spinning and twisting flax, hemp, jute, cotton, silk, wool, and other fibrous substances.

2646. Claude Brison and Antoine Chavanne, Lyons, France—Improvements in ovens, kilns, or furnaces for manufacturing or other purposes.

2647. John W. Wilson, Barnsley, Yorkshire—Improvements in machinery for digging and cultivating the soil, and in steam engines for agricultural purposes.

2648. Henry Keach, Bedford Terrace, Andover Road, Holloway—An improvement in the manufacture of cigars.

2649. Joseph F. V. Deliry, Soissons, France—An improved mechanical kneading trough.

2650. Augustin Morel, Roubaux, France—A new machine for combing all filamentous materials.

2651. James Kirkwood, Paisley, Renfrewshire—Improvements in looms for weaving.

2652. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in railways and in iron pavements and railways combined, parts of which improvements are applicable to the construction of railway chairs and to cast iron pavements for ordinary streets.—(Communication from Barzillai C. Smith, Burlington, New Jersey, U.S.)

2653. Robert Crammond, Newtown, Roxburgh—Improvements in self-acting railway signals.

3654. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in preventing and removing deposit in steam boilers and other vessels, and in the apparatus employed therein.—(Communication from Joseph Harrison, Philadelphia, U.S.)

2655. John Marshall, Great George Street, Westminster—Improvements in traction engines and wheels, and in carriages to be drawn by traction engines, which improvements in wheels are applicable to common road carriages generally.

2656. Isaac L. Pulvermacher, Oxford Street—Improvements in apparatuses for the production of galvanic and magneto-electric currents, and in machinery employed in making some of the apparatuses.

2657. William B. Lord, Plymouth, Devonshire—An improved plug and socket or apparatus for closing and opening passages for the flow of liquids and fluids.

24th October, 1861.

2658. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in lamps for burning coal-oil and similar fluids.—(Communication from Joseph Thomas, New York, and Joseph T. V. Kirk, Philadelphia, U.S.)

2659. Joseph Baker, Birmingham, Warwickshire—An improvement or improvements in ever-pointed pencil cases.

2660. Alexander F. Campbell, Great Plumstead, Norfolkshire—Improvements in railways.

2661. Timothy Morris, Robert Weare, and Edward H. C. Monckton, Trafalgar Square—Improvements in magnets, induction coils, and in insulating wire and metal for electric and other purposes.

2662. John C. Heaton and John Dean, Rotherham, Yorkshire—Improvements in the construction of taps or cocks.

2663. William Dicks, Floore, Northamptonshire—Improvements in water meters.

2664. James Chesterman, Sheffield, Yorkshire—Improvements in heating steel and iron, and in hardening and tempering steel, and in apparatuses employed therein.

2665. John M'Call, Houndsditch, and Bevan G. Sloper, Walthamstow, Essex—An improvement in the preservation of articles of food.

2666. Robert A. Boyd, Southwark, Surrey—Improvements in apparatuses for singeing pigs.

25th October, 1861.

2667. Edward S. Tucker and Frederick E. Manners, Red Lion Court, Fleet Street—The construction of revolving and moveable surfaces applicable to the exhibition of advertisements, show cases, transparencies, and other like matters at fixed stations.

2668. William Wharton, Birmingham, Warwickshire—Improvements in the manufacture or construction of springs for railway and other vehicles.

2669. Enoch Chamber, Melbourne, Victoria—Of the use of hydraulic power for the breaking, crushing, or pulverizing of quartz, blue stone, or other stone or mineral of any description, and the use of a wrought iron lever or jaw in machines for crushing quartz or any other mineral, and the use of steel teeth and steel shield pieces for the levers or jaws in such machines.

2670. Charles N. May, Devizes, Wiltshire—Improvements in garden pots.

2671. Edward Green and Edward Green, jr., Wakefield, Yorkshire—Improvements in apparatuses for generating, superheating, and condensing steam.

2672. Simon Oppenheim, South Street, Finsbury—Improvements in the manufacture of printed shirt fronts.

2673. Lazare Aron, South Street, Finsbury—Improvements in cravats and their mode of attachment.

2674. Edouard Alexandre, South Street, Finsbury—A pedal box for musical instruments.

2675. Thomas Moore, Regent Circus, Piccadilly—Improvements in windlasses and in checking or stopping chains worked thereby.

2676. Jean B. Schalkenbach, Treves Rhenish Prussia—A new kind of musical instrument of the pianoforte class, including harmoniums and organs.

2677. Thomas Richardson, Newcastle-on-Tyne, and Robert Irvine, Hurlet, Renfrewshire—Improvements in treating bones and gelatine.

2678. Henry Gilson, Festiniog, North Wales—Improvements in slate dressing machines for cutting and trimming the edges of slates.

2679. James Lobb, Dartmoor, Devonshire—Improvements in gunpowder suitable for blasting.

2680. Bernard J. la Mothe, New York, U.S.—Improvements in the construction of metallic railroad cars and other vehicles.

26th October, 1861.

2681. Nathaniel Cox, Cheshire—Improvements in the mode of connecting and attaching "armour" plates when applied to ships, forts, batteries, and such like.

2682. Frederic Barnett, St. Mary Axe—Improved electric danger signals for railways and other cognate purposes.

2683. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improved apparatus for ascertaining the presence and degree or cessation of vitality in the human body and in animals of the higher class, applicable to the semeioses of health, disease, and death.—(Communication from Léou V. Collongues, Grande Rue Passag-lez-Paris.)

2684. William Robertson and John M. Hetherington, Manchester—Certain improvements in mules for spinning and doubling.

2685. John Sidebottom. Harewood, near Mottram, Cheshire—Certain improvements in machinery for cleaning and carding cotton and other fibrous materials, and for making partial tubes for the spindles of spinning and other machines.

2686. Jean L. Sicard, South Street, Finsbury—An improved apparatus for purifying, measuring, and weighing grain and oleaginous seeds.

2687. Francis Wrigley, Manchester, Lancashire—Improvements in the construction of railway wheels and wheel tyres.

2688. Samuel H. Parkes, Birmingham, Warwickshire—Improvement in watch keys.

2689. James L. Norton, Belle Sauvage Yard, Ludgate Hill—Improvements in beating, stretching, and drying fabrics, and in the apparatus employed therein, part of which apparatus is also applicable for thrashing linseed.

2690. Robert B. Greenwood, Durham Place, East Hackney Road—An improved billiard rest.

2691. William Taylor, Newport Pagnell, Buckinghamshire—Improvements in joints or connections for metal and other pipes and tubes.

2692. Charles Stevens, Charing Cross—Improved apparatuses for indicating escapes of lighting gas from the conveying pipes, and determining the precise leaking places of the said pipes.—(Communication from Charles A. Fournier. Paris.)

2693. George Hutton, Manchester, Lancashire—Improvements in hats, caps, and other such coverings for the head.

2694. William Smith, Leek, Staffordshire—Improvements in the preservation of stone, brick, and other such materials used in building, applicable also to the waterproofing of walls.

28th October, 1861.

2095. Emory M'Clintock, Fleet Street—Improvements in the manufacture of soda and sulphuric acid.

2096. Bartolomeo Predavalle, Fleet Street—A new mode of and apparatus for producing and obtaining an hydro-pneumatic motive power.

2097. George W. Watson, Rotherhithe, Surrey—An improved mode or method of reefing fore and aft sails.

2698. William Ryder and Thomas Ryder, Bolton-le-Moors, Lancashire—Improvements in machinery for fluting rollers.

2699. William Clark, Chancery Lane—Improvements in the means of obtaining and producing printing surfaces.—(Communication from Alphonse E. Aufray and Francois G. L. Tahar, Boulevart St. Martin, Paris.)

2700. Georgo M. Gilbert, Albany Terrace, Britannia Square, Worcestershire—Improvements in preparing blue colour, and in apparatus for applying such colour to water.

2701. Charles Audouy, Paris—Improvements in the mode of and apparatus for raising sunken ships and other sunken bodies, and also in structures or apparatus intended for being purposely sunk and raised.

29th October, 1861.

2702. John Watt, Lorrimore Street, Walworth, Surrey, and Thomas S. Haviside, Cornhill—Improvements in the manufacture of soap.

2703. Oliver Bayliss, Birmingham, Warwickshire—Improvements in double sighted double rifle guns for military and sporting purposes.

2704. Joseph Martin, Liverpool, Lancashire—Improvements in granaries and the apparatus connected therewith.

2705. Edmund Suckow and Edward Habel, Manchester, Lancashire—Improvements in anti-friction mechanism for receiving the end thrust of screw propeller and other rotating shafts.

2706. John Bibbington. Rochdale, Lancashire—Improvements in machinery for breaking and crushing limestone and other hard substances.

2707. Frederick Bennet, Bagillt, Flintshire—An improvement in the manufacture of spelter.

2708. William H. Furlonge, Mark Lane—Improvements in the condensation of steam by surface contact.

2709. William Savile, Nottingham—Improvements in machinery or apparatus for the manufacture of elastic surgical stockings, socks, knee caps, belts, bands, or other articles.

2710. Richard Gibbon, Brentford—Improvements in machinery or apparatus for preparing grain for brewers.

2711. John Eaglesfield, Devizes, Wiltshire—Improvements in gas burners.

2712. John S. Jackson, Pendleton, Lancashire—Improvements in the treatment of woven fabrics known as cards.

2713. Michael Scott, Parliament Street, Westminster—Improvements in hydraulic presses.

2714. John Hayward, Everton, Liverpool, Lancashire—Improvements in raising water or other fluids.

2715. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery for enamelling moulded and other surfaces.—(Communication from Robert Marcher, New York, U.S.)

2710. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in the preparation of treatment of skins and hides.—(Communication from Dr Friederich Knapp, Munich, Bavaria.)

30th October, 1861.

2717. Richard R. Priestley, Glasgow, Lanarkshire—Improvements in the manufacture of woven fabrics.

2718. Marc A. F. Mennons, Rue de l'Echiquier, Paris—An improved composition for igniting lucifer matches.—(Communication from Messrs Auguste Halinbourg and Léopold Ber, Faubourg Poissonière, Paris.)

2719. Marc A. F. Mennons. Rue de l'Echiquier, Paris—Improvements in the construction of horticultural cases.—(Communication from Léon A. Binet, Levallois, France.)

2720. Evan Leigh, Manchester, Lancashire—Improvements in the construction of sailing ships and other vessels.

2721. Edwin Bodin, Worsley Mills, near Manchester—Certain improvements in the construction of lamps.

2722. William Cowper, Oldham, Lancashire—Improvements in machinery for cutting or dividing wood into scantling or laths.

2723. Robert W. Winfield, Birmingham, Warwickshire—A new or improved manufacture of pulley rods for curtains commonly called "French pulley rods."

2724. Robert W. Winfield, Birmingham, Warwickshire—An improvement or improvements in ornamenting metallic bedsteads and other articles of metallic furniture.

2725. William Cook, Brixton, Surrey, and Henry Cook, Manchester, Lancashire—Improvements in printing telegraphs.

2726. Eugene de Bassano and Adolphe Brudenne, Brussols, Belgium—Improvements in the manufacture of stearine.

2727. James L. Norton, Belle Sauvage Yard, Ludgate Hill—Improvements in apparatus for raising water.—(Communication from William Aldon, Boulevart Bonne Nouvelle, Paris.)

2728. Alfred Topham, Joseph Topham and Jabez Topham, St. Pierre les Calais, France—Improvements in the manufacture of lace.

2729. Richard A. Brooman, Fleet Street—An improved steel button, and method of manufacturing the same.—(Communication from Henri Jesson, Paris.)

2730. Edward Watson, King Street—An improved fastening for buttons, studs, solitaires, brooches, civil and military decorations. and other like articles.

31st October, 1861.

2731. Brownlow H. Mathew, Saint James's—Improvements in fire-arms, and in cartridges.

2732. John A. Fanshawe and James A. Jaques, Tottenham—Improvements in the construction of steam generators.

2733. George Norman, St. Matthias Place, Stoke Newington Green—Improvements in the mounting of cots or cradles.

2734. John A. Fanshawe and James A. Jaques, Tottenham—Improvements in railway carriages.

1st November, 1861.

2735. George Holcroft, Manchester—Improvements in blast furnaces for smelting ores.

2730. Lynall Thomas, Union Street, Berkeley Square—Improvements in rifled ordnance and projectiles.

2737. David Lang, Skinner Street, Snow Hill—Improved moulded india-rubber boots, shoes, and other like articles.—(Communication from Germain Burnet, Rue de l'Echiquier, Paris,)

2738. William J. Williams, Warnford—An improved process for correctly transmitting the effect of the main levers in platform scales to the steelyard or weighing beam of platform scales.

2739. William Clark, Chancery Lane—Improvements in photograph albums.—(Communication from Claude M. A. Marion, Boulevart St. Martin, Paris.)

2740. Elizabeth A. Maling, Whitehead's Grove, Chelsea—Improvements in glass cases for the cultivation of plants and flowers.

2741. Thomas B. Whitehead, Collyhurst Road, Manchester, Lancashire—Improvements in steam boilers, applicable also to other vessels or chambers containing steam.

2742. James Higgins and Thomas S. Whitworth, Salford, Lancashire—Improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.

2743. Benjamin Mitchell, Greenwich, Kent, and William Brunton, Penge, Surrey—The improvement of scissors and shears.

2744. Robert Mushet, Coleford, Gloucestershire—An improvement or improvements in the manufacture of cast steel or of homogeneous iron.

2745. Myer Myers, Maurice Myers and William Hill, Birmingham, Warwickshire—Certain improvements in metallic clips or joints for holding, connecting, and adjusting crinolines and other like purposes.

2746. Andrew Smith, Mauchline, Ayrshire—Improvements in producing or delineating ornamental surfaces.

2747. Richard R. Priestly, Glasgow, Lanarkshire—Improvements in the production of cotton, worsted, or composite yarns.

DESIGNS FOR ARTICLES OF UTILITY.

Registered from September 27 to Nov. 7, 1861.

Sept.	27,	4410	John Harrison, 25½ Ann Street, Birmingham.—"Harrison's Universal Luggage Label."
"	27,	4411	Ransome and Sims, Ipswich.—"Pig Trough."
"	28,	4412	Richard Bestell, 35 High Street, Croyden.—"The Victoria Safety Brooch Fastener."
"	28,	4413	William Owen, Phœnix Works, Rotherham.—"Improved Stable Fittings."
Oct.	5,	4414	William Spurrier, Birmingham.—"Part of a Combined Cruet Frame and Call Bell."
"	7,	4415	R. Laidlaw and Sons, Edinburgh.—"A Wet Gas Meter."
"	31,	4419	W. Purkis Jones, Nichols Square, Hackney Road.—"Universal Telescope Spring, or Elastic Blind Pulley."
Nov.	4,	4420	W. Pope and Co., Temple Street, Bristol.—"Gas Pipe Wrench."
"	7,	4421	Messrs Mechi and Bazin, 112 Regent Street, and 4 Leadenhall Street.—"The United Service Travelling Case."

His Late Royal Highness the Prince Consort.

Although fully sharing in the universal sympathy and sorrow felt at the loss sustained by the nation, by Her Majesty the Queen, and by her family, in the death of His Royal Highness, the late Prince Consort, the character of this journal precludes obituary notices of persons, however elevated in rank, unless connected in life, with Science, Manufactures, or the Arts, or in some way ministering to their progress.

It is as having high claims to rank in this illustrious guild that we thus pay our brief and respectful homage to the character and life, not alone of the Prince, but of THE MAN.

If true greatness be tested by the impress for good we leave upon our place and time, it assuredly belongs to the memory of Prince Albert, in the stamp set by him upon the Art Manufactures of Great Britain.

THE ANNEALING TEMPERATURES OF METALS AND CRYSTALLIZATION PRODUCED BY VIBRATION.

Few examples, numerous as these are in all directions, more strongly indicate the intimate and important, although far from superficially obvious, relations, that subsist between the higher physics and the most common and humble practical arts, than do those which concern the molecular properties of the applied metals under the various conditions to which practical uses subject them. Upon two classes of molecular change in metals we propose to offer some remarks, on both of which much remains to be known.

The construction and the safety of the millions of railway wheels that carry men and merchandise over the civilized globe, (with the small exception of the untyred wheels used in North America,) and of all the future ordnance of the world—for towards built-up guns it all assuredly tends—alike depend upon the "shrinking on hot" of one ring of metal over another.

The *amount* of shrinkage, the degree of coercive radial compression produced by the ring or tyre, and the co-ordinate tension suffered by the latter, are all important to be known, or determinable beforehand, and this knowledge demands our acquaintance with certain molecular changes induced in metals (and more especially in iron and steel) by alterations of temperature which, up to the present moment, are almost wholly unknown. The result is, that the "tyreing of wheels" is, we may say, altogether a matter of "rule of thumb," and the shrinking on upon each other of the successive plies of rings of built up guns, such as "the Armstrong," equally one of "trial and error," and in every individual piece "shrunk on," one of danger and uncertainty in result at the best.

The effects of such empirical practice as respects wheels were rendered terribly apparent during the last severe winter upon nearly all our great lines of railway. The mere dropping of our winter cold a few degrees below the average temperature of our climate produced day after day (and worst of all at night, when the temperature was a minimum) the bursting of innumerable tyres, attended with loss of life and property, and with obstructed railways, until at length the danger became so great that the speed even of our mail trains was, with the consent of Government, temporarily reduced upon most of our great lines of communication.

Another winter has come, which possibly may be as severe, yet our engine and carriage, and truck wheels, remain just as they were, with the exception of some inventions, patent or otherwise, proposing to "get into the rere" of the difficulty by abandoning shrunk on tyros altogether, a thing not likely for general adoption—in fact impossible to be adopted at once, if ever so perfect, and leaving out of view the huge existing stock of wheels that must be worn out, safe or unsafe.

Nothing has been done in the only true direction, namely, that which shall enable us to know what we are about when we "shrink on a tyre."

We are not now going to write either about the constructive form or parts of wheels or detail of railway wheel making, still less about "building up" cannon; but we mean to offer some remarks upon what lies at the foundation of both, coupled also with some upon a closely allied set of molecular conditions, upon which the safety and durability in service, both of wheels and of guns, has been assumed greatly to depend. Our object is to direct the attention of our physical philosophers and educated engineers to our ignorance, and, while we ask these "light bearers" to illuminate us practical men in the directions in which we want light, to suggest, in part, the means by which science may hope to attain it.

When a cylindric iron ring, like a wheel tyre or gun segment, which just fits a solid cylinder on which it is placed, is reduced in temperature, and, therefore, diminished in length, it has been long assumed by writers on physics that, for each depression of 15° of Fahrenheit's scale nearly, a diminution of length will take place equal to about $\frac{1}{10000}$ of its length; and as the extension of a bar of wrought iron of mean quality is about the same, when extended by a force equivalent to one ton per square inch, so the tangential tension or grip of the ring is said to equal a ton per inch of section for each 15° Fahrenheit lowering of temperature.

This is, *in no case, strictly true*, though, within the limits of a few hundred degrees above or below a temperate atmosphere (say 50° Fahrenheit), it may approximate to fact.

At much higher temperatures, however, what happens? Take the case of a railway tyre shrunk on the wheel it has been fitted to, at some temperature between black redness and bright redness. Here two new phenomena come into play. The metal, heated until its molecular condition is altered, and more or less of its rigidity gone, and replaced by a new state of ductility and softness, amounting in the higher extremes almost to plasticity, *is no longer in a condition to transmit the force* of its own contraction, and the latter is expended, not in labouring force at any point of the circumference, but in work done within the particles of the bar, in altering its form and *increasing* its length permanently, and the final effort of the lost heat, expended in "grip," is only the *residual strain*, or difference between the total force of contraction due to the entire heat laid up in the applied ring, and that already expended in permanent alteration of form. The ratio between these two portions of the total force of the heat varies, as the ring is shrunk on at a lower or a higher temperature, in virtue of the facts chiefly ascertained by the Franklin Institute, bearing upon the loss of ultimate passive resistance to tension, produced in iron by continuous elevation of temperature. Thus, at 900° Fahrenheit, the resistance to tension is reduced in round numbers $\frac{1}{4}$th, at 1050° $\frac{1}{2}$, at 1240° $\frac{2}{3}$ds, at 1317° $\frac{7}{10}$ths, and at 3945° Fahrenheit, the fusing point, it of course becomes zero. So that, if we take the average resistance to rupture at common temperatures of a wheel tyre to be 24 tons to the inch of section, and shrink it on at different higher temperatures, the succeeding table will show the proportion in which the total force of contraction is divided between grip and elongation of the ring.

Temperature.	As known by Workmen.	Effort of Contraction per sq. inch.	Effort of Elongation per sq. inch.
900° Faht.	Black Red.	18 Tons.	6 Tons.
1050° "	Low Red.	12 "	12 "
1240° "	Bright Red.	8 "	16 "
1317° "	Yellow.	7 "	17 "
3945° "	White.	0 "	0 "

It follows that, *cateris paribus*, the grip depends not only upon the lowest temperature to which the ring is exposed, but also upon the highest temperature at which it is shrunk on. But, besides the continual though not equable reductions in tenacity due to increase of temperature, another molecular condition comes into play, in "shrinking on hot," which, at a certain though unknown point of elevation, produces an abrupt, permanent, and often large reduction in the tensile strength of the iron, as well as alteration in the preceding relations.

At a determinate, though as yet undetermined temperature, the iron becomes *annealed*. The arrangement of its particles, as induced by rolling, &c. (to still confine ourselves to the illustration of the tyre) is altered again when heated to a *certain* point; their relative distances are increased, as evidenced by diminished specific gravity, and the tensile strength at the same moment greatly decreased. Salient examples of this are familiar in brass or steel pianoforte wire: as these come hard and elastic from the draw plate, the former has a tensile resistance of 87,000 lbs. per square inch (nearly that of wrought-iron), and the latter of 120,000 lbs. per square inch, or even more. In this state either metallic wire coiled round a cylinder (such as one of the wire-wrapped guns proposed by Mr Longridge) would transmit in "grip" very nearly the whole tension due to its reduction in length for each thermometric degree. But let the brass wire be heated to something above a red heat in daylight, and the steel wire to a still more elevated temperature (a yellow heat in daylight at the very least), and the ultimate tenacity of each is found enormously and suddenly reduced. The brass wire will now tear asunder at 17,000 or 18,000 lbs. per square inch, and the steel at 70,000 to 80,000. Both, however, elongate greatly more than before, so that it is probable that the coefficient (*of Poncelet*). that is to say, *the foot pounds expended in the work of rupture*, is the same before and after annealing; but inasmuch as the "grip" in any given case greatly depends upon the relation between the range of elongation by tension, and the final resistance to rupture—in other words, upon the ratio between the two factors, of which the above co-efficient is made up, so without a knowledge of the precise temperature at which this sudden molecular change called annealing takes place, our operations of shrinking on must, in this second respect, remain but tentative and unsatisfactory.

Now the fact is, that the "annealing temperature" has not been yet ascertained for any one metal, and all that is known about it is, that there is a fixed and rather narrow range of elevated temperature peculiar to each metal, without the limits of which, annealing does not take place, and that the absolute mean temperature for each metal seems to be greater in some proportion as the fusing temperature of the metal itself is higher. Platina, for instance, when hard from wire drawing or lamination, is not annealed under an intense white heat; wrought-iron at about a bright red; in some sorts, not before a yellow heat; copper, at a low cherry red; and when we come down to the metals of very ready fusibility, such as tin and lead, their annealing temperature appears to be so low that the *heat evolved* in them by conversion of mechanical force, in laminating or wire drawing is sufficient to keep them annealed, *i.e.*, they *cannot be hardened* by such processes. It is this curious fact of molecular physics which affords the explanation of the circumstance well known to those engaged in the trades of rolling sheet lead, or "drawing" lead pipes by the older methods, namely, that the rolling or drawing can be accomplished by a *less total expenditure of power* if performed fast than much more slowly. That is to say, the power demanded is a minimum when the pressure is sufficiently sharp to evolve the heat of annealing in the lead. Upon a like condition (with others not here in question) depends the curious process of forcing up in pure tin the patent collapsible vessels of Rand now so extensively in use for receptacles of oil colours, perfumes, &c.

Baudrimont, a French chemist and physicien, has published some most important researches (so far as they go) on annealing temperatures, which may be found in *Ann. de Chim. et Phys.* Tom. ix.; but as respects the *precise* temperature at which annealing takes place, he has only shown, that within certain not very wide limits annealing may be produced if the temperature be long continued; but that there is one point at the highest end of the scale at which annealing takes place instantaneously. To ascertain this point rigidly for all our more important metals would be most desirable, and we would offer to the physical experimentalist some hints as to a method by which probably the investigation might be advantageously pursued.

It has been proved by Magnus (*Ann. de Chim. et Phys.* Tom. xxxiv. 3 *ser.*) and verified by others, that no thermo-electric current can be produced by the heating of any part of a metallic wire, the whole length of which is in the same molecular condition, and its whole surface in the same state, *i.e.*, all polished and free from oxide, &c.

Magnus further ascertained that when one portion of the length of wire was *hard* as it came from the draw plate, and another portion of it had been previously *annealed*, that then, when heat was applied at the point of junction of these respective portions a thermo-electric current was produced, and gave large deflections with the galvanometer; and that the production of the current was due to a difference in molecular arrangement in the hard and in the annealed portions, and not merely to a difference in their conductivity of *heat*. This he ascertained by showing that annealed and unannealed wire were in this respect the same.

If, then, we arrange a metallic wire or bar, having segments as above, one portion hard, the other annealed, so that it shall pass through a gas flame or furnace, or metallic bath, or other means of heating at the juncture of the segments up to known temperatures, we should expect to find the deflections of the galvanometer increase steadily as the temperature of the bar or wire rises until the moment when such a heat is applied that annealing takes place in the *un*annealed segment of the wire. At this moment the thermo-electric current ceasing altogether, the needle will retrograde to zero, or to its original point, before heat was applied. This occurrence will signal the accomplishment of the molecular change, and the temperature at the moment may be read off from the pyrometric instrument employed and placed in the flame or furnace. Many precautions, some probable difficulties requiring preliminary experiments to disentangle, will readily occur to the physicien, and with him we must leave the subject now. It would be out of place here for us to enter more fully into a purely experimental subject. We have, we trust however, pointed out to the practical man some at least of the sources of difficulty and uncertainty that appertain to his operations of "shrinking on," and in doing so indicated the road by which, with the help of the man of experimental science, he may extricate himself from them.

At the commencement of this paper we put in words, another class of molecular changes, in virtue of which tyres, axles, cannon, and all things formed of metal are presumed, in course of wear and use, to become deteriorated, weakened, or destroyed, namely, crystallization produced by vibration. We shall reserve the consideration of this, however, to a separate article in a future number.

The subject is one of such great practical importance, it is one so little understood, it appears so ill-digested on the part of even some of our leading practical experimentalists on iron, and engineers, and is withal so frequently the subject-matter of ignorant or half-informed remarks in our mechanical journals, and on the part of their correspondents, that we shall best devote to it a separate article.

THE OCTAVIA AND THE MOOLTAN STEAMERS.

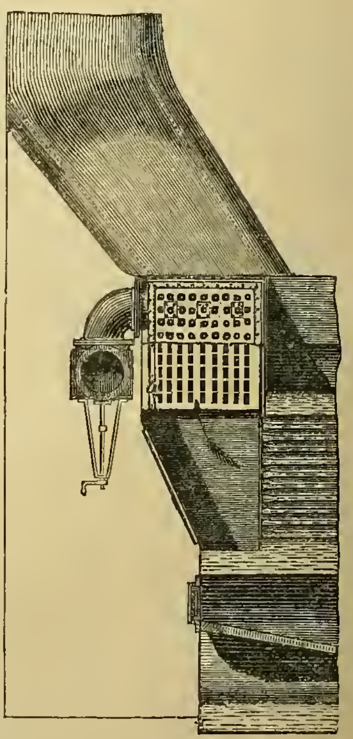
Within the last few days, two most important trials of steamers have been completed, each fitted with engines by different makers of high reputation, and claiming, as we believe with perfect truth, to have in each instance respectively, outstripped their previous achievements in the production of high rates of speed, with greatly reduced consumption of fuel.

The first of these steamships, the *Octavia*, was officially tried at Stokes Bay on the 20th ult., and with the more than usual interest, that she is in fact, as respects her engines, &c., a competitive ship, the machinery of two others, the *Constance* and the *Arethusa*, having been confided by the Admiralty to Messrs Penn & Son, and Messrs Randolph & Elder. In each of the three cases, the objects held in view have been to carry out to the utmost, every known modern improvement tending to the economization of coal, that condition of all others the most primary and important to the effective value of a ship of war—being in fact the measure of the period during which she can keep the sea uninterruptedly.

The second of the two completed trials to which we have referred consists in the return of the *Mooltan* from her voyage to Alexandria and back, by which we have the results accomplished in a voyage of 6000 miles, and can compare the facts of actual and sustained work with those deduced from her official trial after her launch, and run round to Southampton.

Returning to the *Octavia*, almost everything about both her boilers and engines, bears the stamp of novelty, though there is nothing new in principle. Her boilers are constructed with one of the forms of superheating apparatus patented by Mr Joshua Field. The engines are of the construction patented by Mr Charles Sells, an engineer connected with the firm (Maudslay, Sons & Field), and we are enabled, through special information communicated by that gentleman, to give the following account of her machinery and performance.

Fig. 1.

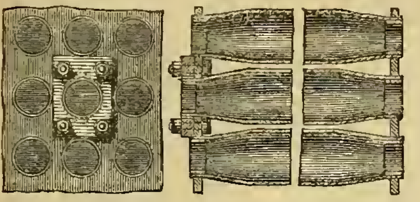


The form of superheating apparatus adopted is shown in fig. 1, and the mode by which the flattened but round-ended tubes are got in and out, or repaired, is seen in fig. 2.

The arrangement is thus described by Mr Field in his specification (No 1974, dated 30th August, 1859.)

"In my apparatus for superheating steam, the steam is made to pass through a system of flattened tubes, which are placed in the uptake in such a position as not to interfere with getting at the ends of the boiler tubes for cleaning or renewing them, and so as to offer the least resistance to the heated gases, and give the requisite area for their passage to the chimney, while at the same time the surface of the tubes is brought well into contact with the heated gases which pass up between them. The tubes are placed in rows one above the other, and have their ends fixed into steam boxes, one of which receives the steam direct from the boilers, while the other has communication with the main steam pipe leading to the engine. The ends of the flattened tubes are left round, and are fixed in the tube plates of the steam boxes with ferrules in the ordinary way, but as the flattened portion of the tubes will not pass through the round holes in the tube plates, I divide the tubes into groups of nine, as near as may be, and make the holes in one of the tube plates for the central tubes of the groups, of such a form and size as will readily allow the flattened tubes to pass through them, and then bolt on to the plate small flange plates with round holes, into which the ends of the tubes are fixed in the ordinary way. By this arrangement any one of the surrounding tubes may be taken out and renewed, when required, by first removing the central tube of its group with the flange plate on its end, and then withdrawing the defective tube through the central hole made for that purpose. The sides of the tubes, placed in rows above one another, present a nearly flat surface, which may be readily cleaned with brushes through doors made in the chimney uptake; but in cases where it is not convenient to clean them in that way, I propose to use a scraper worked from the outside for the purpose. Also, in cases where it is convenient to do so, I prefer to provide additional passages for the heated gases, with the requisite dampers for shutting off the passages through the superheating apparatus, which may be used in case of the apparatus requiring repair, so that it may not be injured when it is found necessary to shut the steam off from it."

Fig 2.

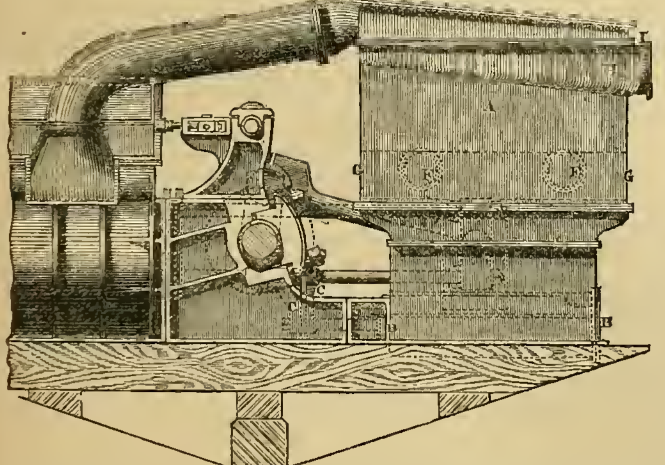


The feedwater is passed through a hollow thin plate in front of the superheating apparatus, which is properly studded to secure the requisite resistance to internal pressure, and is placed at *a*, fig. 1, so that it may become heated by the otherwise waste heat of the flues before entering the boiler.

The engines were patented also in 1859, (No. 2758,) and are thus described by Mr Sells, the patentee :—

"My invention consists in an improved arrangement of horizontal engine for screw propulsion, designed for the purpose of effecting great economy of fuel by using the steam very expansively for obtaining a uniform and equable power, and for obviating the vibratory motion at present communicated to vessels from the action of the engines when two only are used. For these purposes I employ three cylinders, placed together side by side, the area of which should be increased about $\frac{1}{3}$ or $\frac{1}{2}$ more than usual when intended for working with a great amount of expansion. The cylinders have a three-throw crank shaft immediately in front of them. Each cylinder has two piston-rods, one passing above, and one below the shaft, connected to a cross-head, with the connecting-rod returning back to the crank. Nearly opposite each of the two outer cylinders is placed a condenser, with its horizontal air-pumps. The air-pumps are worked direct from the pistons of the opposite cylinder or by an arm from one of the piston-rods; each of the condensers and air-pumps serves for the condensation of the steam from its opposite cylinder, and for one-half of the steam from the centre cylinder. In order to cut off the steam at an early part of the stroke of the piston, and as close to the cylinder as possible, I dispense with the ordinary expansion valves, and adapt the slide valve for that purpose, and employ an improved apparatus for shifting the position of the eccentrics, so as to be enabled to cut off the steam at the time required. This apparatus is also used as a starting and reversing gear, and consists of a train of two or more spur wheels, mounted in a moveable frame for communicating the motion from the spur wheel on the main crank shaft to a spur wheel on the crank or eccentric shaft for working the slides; this frame may be raised or lowered by suitable means, so as to cause the eccentric shaft to revolve to the extent required for effecting the intended operation; and as the opening of the ordinary slide valve for the admission of the steam becomes very much reduced when the lap is proportioned for cutting off the steam at an early part of the stroke, I employ an improved description of slide valve, having one or more additional facings, with the corresponding ports into the cylinder for the admission of the steam, so as to obtain the requisite amount of steam opening without increasing the area of the eduction openings.

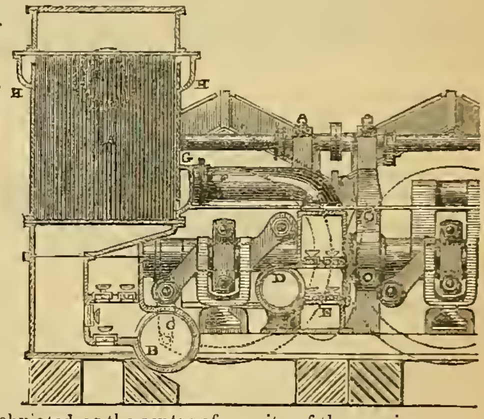
Fig. 3.



"Fig. 3 is an end elevation, and fig. 4 a side view, at right angles to fig. 3, partly in elevation and partly in section, fitted with surface condensers, and the necessary cold water-pumps, one half of the engine being shown in this figure. In this arrangement I work the air-pump by an arm from one of the duplex piston-rods of the outer cylinders, and the cold water-pumps, (which are also placed opposite the two outer cylinders) are worked by rods direct from the pistons. A are the surface condensers, with the water circulating between the tubes, while the steam is condensed within them; B are the two air-pumps worked from the piston-rods by the arms, C; D are the cold water-pumps, with their foot and delivery valves, worked by rods direct from the pistons of their opposite cylinders; E are the suction pipes, leading from the side of the vessel; and F are the delivery pipes leading to the lower parts of the surface condensers by the passage way, G, which has an opening at its lower part, while the hot water passes away from the top by the passage way, H, and overboard by the discharge pipe, I.

"These are firm and compact arrangements of engines especially suited for working the steam with a great amount of expansion, as by the employment of three cylinders with their cranks placed at an angle of 120° with each other, the power is rendered nearly uniform. The whole of the working parts are kept well in view, and are easy of access at all times while at work, which is very essential in quick working engines, while, at the same time, much of that unpleasant motion felt in screw vessels is obviated, as the centre of gravity of the moving parts is always nearly in the same position with regard to the vessel.

Fig. 4.

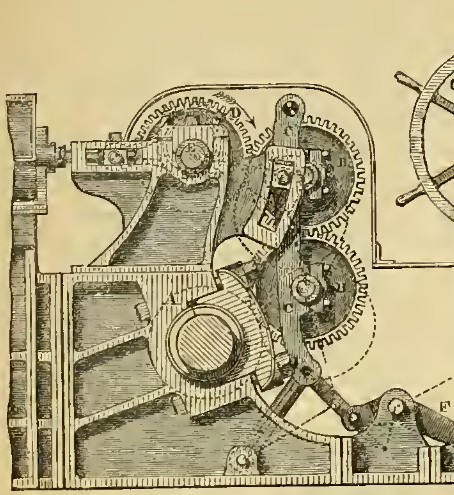


"Fig. 5 is an elevation, and fig 6 a plan of the apparatus for shifting the position of the eccentrics. I propose to proportion the slide valve to shut off the steam at $\frac{1}{4}$th of the stroke, when the valve is made to commence opening the steam ports just at the beginning of the stroke of the piston or when the crank is just passing its centre, and when required for starting the engines the eccentrics may be set backwards, so as to allow the steam to dwell on until about $\frac{1}{2}$ of the stroke, and when required to work with a greater amount of expansion, they may be set forward, so as to cut off the steam at the time required. The alteration in the amount of expansion may be effected without materially altering the admission of the steam into the cylinder. In these two figures, A is the spur wheel on the crank shaft, which gives motion by means of the spur wheels, B, mounted in the moveable frame, C, to the spur wheel, D, on the eccentric shaft, E, which gives motion to the slide valves. It will be readily seen that by lowering the frame, C, which is guided at its upper and lower ends, so as to keep the wheels properly in gear together, the eccentric shaft will be caused to revolve in the direction shewn by the curved arrow, so that the position of the eccentrics in relation to the crank may be altered at pleasure by raising or lowering the frame; F, is a lever, attached by links to the lower end of the frame, and which is adjusted by the screwed rod, and hand wheel, G. This apparatus is also used for reversing the engines, as the eccentrics may be set forward the amount requisite for performing that operation, in the manner described. I prefer also to use a short eccentric rod, arranged so as to compensate in some measure for the irregularity in the time of cutting off the steam, caused by the limited length of the ordinary connecting rod. Fig. 7, is a sectional view of an ordinary double ported slide valve, with the additional steam facings, *a*, *a*, and the additional steam ports, *b*, *b*, by which I obtain the requisite amount of steam opening when the lap is increased so as to cut off the steam at an early part of the stroke.

Such are the arrangements of both engines and boilers on board the *Octavia*, with some few alterations in the detail, as forwarded to us by their designer, to whom we are also indebted for the following account of her performances on the 20th ult.

The *Octavia* recently tried at Stokes Bay, was originally a 50-gun frigate, built at Pembroke, from the designs of Sir W. Symonds, and has lately been converted into a steam frigate of 500 horse-power, for which purpose she has been lengthened amidships, and at her stern, so as to adapt her for being fitted with a screw propeller. Her dimensions at present are—Length between perpendiculars, 252 feet 4 inches; breadth, extreme, 52 feet 8 inches; and tonnage, builder's measurement 3142 feet. She is one of three experimental vessels ordered to be fitted by the Board of Admiralty with expansive working engines, surface condensers, and superheating apparatus. Her engines are of 500 horse nominal power, and were manufactured by Messrs Maudslay, Sons, & Field, on the plan patented by Mr Sells, of their establishment. They have three cylinders, each of 66 inches diameter, with a stroke of 3 feet 6 inches, working on to a three-throw crank shaft, with the cranks set at an angle of 120° to each other. The cylinders are entirely cased with steam, having steam jackets round their circumference and at their ends, and are intended to work with steam at the usual Admiralty pressure of 20 lbs per square inch. The collective area of the cylinders is about one half greater than in ordinary engines of the same power, it being intended to realise 4 times the nominal power with the steam cut off at ⅙th of the stroke. The steam is shut off entirely by the slide valve, without the use of the ordinary expansion valve. The slides are specially adapted for this purpose. They are double ported slides, as far as the eduction passages are concerned, but have three steam openings, in order to give the requisite area for the admission of the steam. They are worked by a shaft, with suitable cranks, running across in front of the slide jacket. This shaft is driven from the main crank shaft of the engines by a system of wheel work. The two intermediate wheels of this system are mounted in a moveable frame, which may be raised or lowered at pleasure, the effect of which is to vary the position of the cranks on the shaft that works the slides in relation to the position of the engine cranks. By this means, the steam may be shut off at any part between ¼th and ⅐th of the stroke, and, by the same means, the slide cranks may be shifted into the proper position for reversing the engines.

Fig. 5.



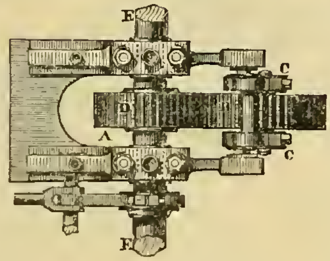
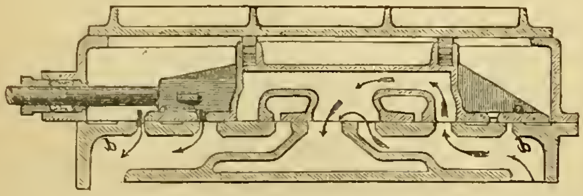


Fig. 6.

Fig. 7.



There are two surface condensers, which are placed, together with their air-pumps, on the opposite side of the vessel to the cylinders, and opposite the two outer ones. The space between the two condensers, over the cylinder crossheads and piston rods, is occupied by the engine platform. By this arrangement, all the working parts are brought well in view, and are easily reached by the engineer on the platform. The condensers are of the description generally known as Hall's, similar in principle to those fitted by the same firm to H.M.S. *Grappler* in 1842. The condensing water surrounds the exterior of the tubes, while the steam is condensed within them. Each condenser is fitted with about 5½ inches of ½-inch copper tube. The condensing water is driven through the condensing tanks by two rectangular plunger pumps, fitted with lignum vitae packings and india rubber foot and delivery valves. These pumps are also placed opposite the two outer cylinders, and are worked by rods direct from the pistons of those cylinders. The condensed steam is pumped by the air-pumps into an open cistern, from which it is forced by the ordinary feed-pumps into the boilers. On its way to the boilers, it is made to pass through a water-casing, fitted to the superheating apparatus, for the purpose of raising its temperature. This arrangement of engines offers the advantage of great economy of fuel, with a comparatively simple arrangement, while, at the same time, it gives an equable power, and the centre of gravity of the different moving parts being always the same in relation to the vessel, it does away with the unpleasant vibration given to the vessel by the moving parts in quick-going engines.

The steam is generated in two tubular boilers of the ordinary construction, which are ⅔rds of the size of those ordinarily fitted on board Admiralty vessels of the same nominal power. In the uptake of each boiler is fitted a superheating apparatus, as patented by Mr Field, of the firm of Maudslay, Sons, & Field, which consists of a series of flattened tubes, through which the steam passes on its way to the engines. These tubes are placed in rows, one above the other, so as to offer the least possible obstruction to the heated gases passing to the chimney, and the apparatus is so constructed that any of the tubes may be readily taken out and renewed should they at any time become defective, without interfering with the others, while at the same time, their exterior surfaces can be easily cleaned from any soot that may be deposited upon them. The screw propeller is on Griffith's patent principle, of 18 feet diameter, and was set at a pitch of 20 feet.

The *Octavia* was taken to the measured mile at Stokes Bay, on the 20th November last, for the trial of her machinery, and her performance was considered in every way satisfactory. The draft of water on the occasion was 18 feet forward, and 20 feet 10 in. aft, giving a mean draft of 19 feet 5¼ inches. The mean speed of the vessel, taken over six runs on the measured mile, was 12·251 knots per hour, the engines working up to the mean number of 69·4 revolutions per minute. The pressure of steam was easily maintained at 20 lbs., and the engines realized rather over 4½ times their nominal power. The temperature of the superheated steam ranged during the trial from 320° to 332°, taken by thermometers placed in the regulating valve box attached to the engines. Four runs were afterwards made with half power, one of the boilers being shut off for the purpose, when the mean speed obtained was 9·09 knots per hour, the engines making 53½ revolutions per minute.

From experiments made it is expected that the consumption of coal in the *Octavia* will be about 50 per cent. less than that of vessels fitted with ordinary machinery of the same power; but this can only be properly tested by a long cruise and a series of accurately made experiments. At the same time the space occupied by the engines and boilers is somewhat reduced, thus leaving a larger space available for the stowage of coal. This, in vessels of war, is a matter of great moment, as their real efficiency must, in a great measure, depend upon the time that they can keep at sea without being obliged to put into port for the purpose of coaling.

Throughout the trial the performance of the machinery was considered satisfactory, and its equality and evenness of movement, with the absence of vibration in the vessel, astonished all on board.

We may append to this account, the particulars of each run made by the *Octavia*, as recorded on the 21st ult., and the rather as recently some difference in practice has been suggested as to the method of deducing the average speed from a given number of runs.

The morning was bright and fine, but with a breeze of wind of quite the force of 4 from west. The following are the results of the six runs made at the mile with full power:—

First Run.—Time, 4 min. 29 sec.; speed in knots, 13·383; pressure of steam, 20lb.; revolutions of engines, 68.

Second Run.—Time, 5 min. 30 sec.; speed in knots, 10·909; pressure of steam, 20½lb.; revolutions of engines, 70.

Third Run.—Time, 4 min. 24 sec.; speed in knots, 13·636; pressure of steam, 20lb.; revolutions of engines, 70.

Fourth Run.—Time, 5 min. 32 sec.; speed in knots, 10·843; pressure of steam, 20lb.; revolutions of engines, 70.

Fifth Run.—Time, 4 min. 23 sec.; speed in knots, 13·688; pressure of steam, 20lb.; revolutions of engines, 70.

Sixth Run.—Time, 5 min. 29 sec.; speed in knots, 10·942; pressure of steam, 20lb.; revolutions of engines, 71.

The vacuum was the same in all the runs—28½lb.

Four runs were next made at half power (one boiler), with the following results:—

First Run.—Time, 5 min. 11 sec.; speed in knots, 11·575; revolutions of engines, 56.

Second Run.—Time, 6 min. 29 sec.; speed in knots, 9·254; revolutions of engines, 56.

Third Run.—Time, 5 min. 31 sec.; speed in knots, 10·256; revolutions of engines, 54.

Fourth Run.—Time, 6 min. 37 sec.; speed in knots, 9·068; revolutions of engines, 50.

The mean of the six runs (full power) was 12·255 knots, and the mean of the four (half power) was, as nearly as possible, 10 knots. The temperature of both engine-room and stoke-hole was of an unusually cool character, as the following figures will prove:—

At 11 30 a.m.—Engines working up to full power, engine-room platform, 51 deg.; stokehole—centre, 68; forward, 55; aft, 58½.

At 1 p m.—Engine-room, 58 deg; stokehole—centre, 80; forward, 65; aft, 68.

At 2 p.m.—Engine-room, 54 deg; stokehole—centre, 80; forward, 65; aft, 69.

At 2 30 p.m, at half power.—Engine-room, 54 deg.; stokehole—centre, 75; forward, 62; aft, 64.

As respects the *Mooltan*, the following notice of the results of her outward and homeward passage from Alexandria has appeared.

THE MOOLTAN STEAMER.—This vessel, respecting the performances of which on an ocean voyage great interest has been felt in nautical and engineering circles, returned to this port on the 26th Nov. from Alexandria. At the time of the *Mooltan's* launch and run round to Southampton, and also on occasion of her official trial at Stoke's Bay, full descriptions of the improvements and mechanical peculiarities introduced in the machinery department, and of the results of her performances, as far as they could then be tested, were published in the *Times*. One of the most novel features is the smallness of her horse-power as compared with her tonnage, and the reduced size of her boilers, which are constructed on Mr A. Lamb's patent, and which are only about half the size of the tubular boilers employed in ships of the Royal Navy for the supply of steam to engines of the same nominal horse-power. The effect of the principle adopted in the *Mooltan*, if successful, will be to materially reduce the consumption of coal, and hence to lessen the expenses and difficulties attendant upon ocean steam navigation. It appears that the most remarkable and successful results have been accomplished in this respect during the recent voyage of the *Mooltan* to and from Alexandria. On the outward voyage she was 268½ hours under way, running 2951 miles, with an actual consumption of 305 tons of coal. and coming home she was 286 hours under way, consuming 325 tons of coal. The total quantity of coal consumed, therefore, during a voyage of nearly 6000 miles, has been 630 tons, against an expenditure of about 1200 tons in other ships of the same tonnage employed on this line. This is a saving of very nearly half, while an average speed has been maintained out and home of 10 64 knots. The average expenditure of coal per hour was 2574lb., and the average power taken by the indicator every watch 1230 horses. During the voyage the *Mooltan's* draught of water was 19ft 4in; average midship section at this draught, 558ft.; and average displacement at same, 3335 tons. The boilers supplied abundance of steam at 20lb.; surface condensers, average vacuum, 27½ inches. These results must be very satisfactory to her engine-builders, Messrs Humphrys and Tennant, and to the patentee of her boilers, and all others concerned, while they are of vast importance to every one interested in steamships; it is important to observe that they have been obtained over a run of nearly 6000 miles, with the ordinary coal used by all the company's steamers, and with the ship's own stokers; and hence they should not be compared with those obtained at the trial of a ship at the measured mile, or on a few hours' working of her engines at moorings, because these short trials are always made under the most favourable circumstances, with picked coal of the best quality, clean fires, and stokers of the greatest skill.

We purposed giving, with the present notice, some details of the engines, &c., of the *Mooltan*; a note, however, received from the designer, Mr Edward Humphrys (Humphrys and Tennant) informs us that, while the *Mooltan* "must be viewed as a great success," he expects so far even yet to improve upon what he has already achieved, by altering matters of detail, in the three sets of engines on the same general model just ordered from his firm—two of 400 horse-power, and one of 500 horse power—that, until these shall have become moving realities, he prefers we should postpone, for the present, adding to what is now before the public.

Maintaining an average speed under way at sea of very nearly 11 miles per hour, her consumption of coal from the average of the whole voyage is but 2·09lb. per indicated horse-power per hour, in all weathers and circumstances. This does not, we presume, include any coal expended in getting up steam; but whether or not, the result co-ordinates with the very best that are obtained in land engines, with unlimited facilities for every known appliance tending to economise fuel, and fully justifies the statement, that the consumption on board the *Mooltan* is about one half that usual in similar vessels, as to size, and power, &c.

Mr Rankine gives in his Thermo Dynamic Theory of Steam Engines, Phil. Trans. for 1859, several examples, taken from some of the best sea-going steam-ships, of the application of his thermo dynamic formula of efficiency. The equation we refer to is $E = \frac{w}{h}$ w being the mean effective work in a cubic foot of steam of known pressure and temperature, and h the heat expended per cubic foot of space traversed by the piston, or the pressure per square foot of piston to which the heat expended is equivalent. Amongst all these examples we find that the efficiency, E, scarcely rises above 0·53, except in one case, and that a somewhat doubtful one, namely, the *Thetis*. The engines in this boat were fitted with Craddock's boilers, exposing *nine times* the usual fire surface. They expanded largely, and the fuel in the one single trial, the subject of Prof. Rankine's deduction, was the very best coal. In this single case, the value of E, from a single trial, appears to be 0·88, the consumption of superior fuel having been but 1·02lb. per hour per indicated horse-power.

Whatever reserve may, as yet, exist amongst practical engineers to accept as definitive the numerical examples deduced by Mr Rankine from a theory of steam power, which, as yet, has made so little way, and, indeed, is scarcely known or understood amongst practicians, although it unquestionably must become *the* theory of steam power of the future, resting as it does upon the only true physical basis upon which a fundamental theory of steam engines can be reared; they at least abundantly show how vast is the waste in our actual average practice of marine engineering, and how great the field, therefore, for improvement, and how wide a stride has been made in the instance before us. And how has this been accomplished? Not by any one change or appliance new in itself, but by the able and experience-guided application and combination of some three or four principles, every one of which has long ago been pointed out and urged as offering a sure road to economisation of heat.

It is nearly thirty years ago since the elder brother of Mr Edward Humphrys, the late Mr Francis Humphrys, whose premature death prevented his great mechanical abilities from becoming as fully appreciated as they surely would have been had he survived a few years longer, was foremost in urging the application of higher pressures and expansive actors in marine engines.

In the *Royal Tar*, a very early ship of the Peninsular and Oriental Company, he actually carried out, about 1834, a steam pressure raised to 15 lbs. to the square inch (at that time looked on as something terrible in sea-going boilers) in boilers of peculiar construction and expansion to a high degree, and variable at pleasure in the engines, and with excellent results. But Francis Humphrys and his improvements were in advance of his day. At that time, to attempt to construct what was then deemed a large set of marine engines with horizontal cylinders was not to be thought of. The weight of the piston resting on the cylinders would "wear it oval," was a sufficient stopper to any thought of the sort. Yet here, in 1861, we have three cylinders horizontal on board the *Octavia*, and hundreds in pairs elsewhere, and no disastrous results follow from the adaptation, which was at last forced upon marine engineers by the necessities of the armed ships of the navy alone.

More than thirty years ago the late Mr Maudslay, then a young man, set to work in model, as we ourselves witnessed, oscillating engines long before they were attempted to be applied either in the Thames or the Clyde; but even his distinguished father then thought them too great an innovation to attempt in the large. They crept into some of our early and smallest of the Thames boats, and now we have the Holyhead boats, as fast at least as any afloat, with 90-inch oscillators on board.

In 1840-42, Samuel Hall wrote and urged nearly all that has ever since been said in favour of surface condensers; but he, too, like F. Humphrys, was far before his time.

Latest of all, has come superheated steam, not as a novelty in principle, but one come again to the surface, and its probable results in application often before indicated by men of physical science, and admitted by every scientific engineer. Its day has come at last. The very first effective trial made of it (at Southampton, if we mistake not), proved that it was just the missing link that was wanting to connect into practical completeness, expansive action, and surface condensation.

The steps of successive improvement in marine engineering have thus been in most respects of like character with those that have brought the locomotive to its present high standard of efficiency. In both cases the principles of improvement that can be enumerated are few and simple. The improvements themselves have come ushered in at uncertain intervals by the force of circumstances—by the trial and error methods of many minds combined, and the accumulated experience of practice cautiously applied.

But how is it that the advance of the locomotive towards its existing stage of perfection has been so much more rapid than with marine engines? Minds of equal power, tact, informed and erudite, with practice as large or larger, have been devoted to marine engineering as to locomotive, and with the stimulus of still greater renown and reward before them. The difference is to be found in the inevitable *conservatism* that must adhere to marine engineering, and will ever continue to act in producing a caution bordering on timidity, in Government offices, managing directors, shipowners and builders, and marine engineers, *par excellence*, whose reputation and fame is also perilled as well as their pockets, when deciding upon questions which involve money stakes so enormous as do decisions on marine engine and boiler construction.

In the case of a single experimental locomotive, involving innovations it matters not how violent, but promising, the stake at issue probably in no case reaches £5000; but in the question of the construction and arrangement of a single set of first-class marine engine and boilers, ten or twenty times the sum may be involved from first to last.

The greater honour then to all concerned in the conception, and in courageously bringing to fruition, improvements such as we now chronicle. That much remains to be yet achieved by the same continued "keeping on the pinch" of trial and error, from known experiences, aided by lucid and exact assistance, from the experimentalist and analyist, is obvious. In nothing is this better evident than on perusing Mr Joules' able paper on Surface Condensation, published in a late volume of the Philosophical Transactions. His experiments prove that of all other things the great "rock in the road" of rapid and effective surface condensation is the film of heated water that is held clinging by capillarity to the surfaces of the condensing tubes, and which, though almost evanescent in thickness—the current of cold water, unless at extreme velocities, is incapable of sweeping away, and whose presence acts as so much material of bad conductivity added to the thickness of the pipe.

Here is a stand-point for the man of ingenious mechanical device to improve our surface condensers. The problem is—required a construction such as shall meet all other conditions, and shall remove or prevent the formation of this heated film. The man who solves it will make a fortune and a name; that is, if he is fortunate enough to secure his just reward for such a benefit conferred upon the steam navy of the world. But hold—a great authority has recently told the world that whenever there is a demand for an invention it can be made forthwith—it is as easy as to find a word in a dictionary, and deserves no more reward. Perhaps Sir Wm. Armstrong will oblige our "inquiring correspondents" ourselves, and marine engineers, and shower unrewarded blessings from the *Cornu Copia* of his inventive powers upon a grateful world, by whispering to us all, the key to the above enigma—even in the briefest way, that may befit the leisure of his *well* employed time. We do not quite expect an answer, remembering what Carlisle says as to *who they are*, that are privileged to find and show to others "*Nature's open secrets*;" for we are clear, that whosoever announces the dogma we have just alluded to, in so doing utters the "Shibboleth" that proves that he himself at least *is not* amongst the gods of that privileged class.

INVENTIONS AND PROTECTIVE PATENTS.

II.

The discussion still floating about in printed writings and spoken debates on this most important subject, which we took partly in hand in November,* is strongly indicative of the existence of a wide-spread misunderstanding as to the true bearings of the point at issue. It shows, on the one hand, that the public scarcely recognises property right in the fruit of invention; and, on the other, that many admit the necessity of protection, but under such a restrictive form as respects the rights of the inventor, that the latter would find his position by no means enviable; whilst there is a third section, which very sensibly regards the existing system, defective as it may be in many points of its practical administration, as not only a proper concession or tribute to the merit of men who thus add to our comforts, but in its just light of an indisputable claim upon the world. Inventive men themselves naturally form the bulk of the last-named division, and they have many friends outside the pale of their own class who generously regard the pursuits of inventors with a disinterested eye, knowing that to them mankind is mainly indebted for its ever increasing stock of comforts, and its now extraordinarily rapid progress in softening the asperities of existence; to such men honour and substantial profit are justly due.

Those of the first section obviously hesitate not to take advantage of every benefit arising from the most valuable conceptions, whilst they ignore the rights of the conceivers; and hence are like such idle consumers of food and raiment, as neither produce anything of themselves, nor contribute in any way to the support of those who do. Strangely enough, we find Mr Baron Bramwell giving his adhesion to this class, for, during a discussion at a late meeting of the Juridical Society, he said, "that people *had got into the habit* of thinking that men had a right of property in what they either invented or wrote. But no such right existed, and it was entirely a matter of generosity that they were secured the emoluments arising from it for a certain number of years. If a man wrote a book, and published it, and another bought a copy of it, the author could not prevent that man from lending it to a third; and if the purchaser had the right to lend it to be read, he had also the right of copying it, and giving the copy to others to be read by them. When Mr Buchanan, in speaking upon the question of international copyright between this country and America, said the Americans would be very foolish to agree to any such thing, as they would then have to pay for that which they now obtained for nothing, he was much laughed at, but he uttered what was perfectly correct, for it was a matter of policy that the public should get out of authors and inventors the most it could, and at the smallest possible price. He was strongly convinced, especially in regard to inventions, that the abolition of the patent laws would not act as an impediment to improvement, but in getting rid of them they would have, to use a mathematical expression, to exercise a function of two varying quantities, viz., the gain and loss to the public, and setting them one against the other, ascertain on which side was the balance of public advantage; and still that would not exhaust the question, which would have yet to be considered, whether a greater amount of advantage or a less amount of loss might not be secured by some other mode of remuneration. The only right either author or inventor had in what he wrote or invented, was the right of keeping it to himself, and if he were to be remunerated for its publication on the plan proposed by M. Boteod, the public interest would have to be well looked after."

These are as the digested views of a man authoritatively pronounced possessing a seat on the bench of administrative justice; a judge who has tried, in his own fashion, not a few intricate patent cases, and who will, no doubt, have to hold the scales during the judicial consideration of a good many more. It is something startingly absurd to learn from so elevated an authority that "people had got into the habit of thinking that men had a right of property in what they either invented or wrote," and that "the only right either author or inventor had in what he wrote or invented, was the right of keeping it to himself." Really, getting into a habit in this way, is by no means confined to matters connected with authors and inventors. It is a habit which the members of every class of business form with the most natural facility. It is shared in common by the shop-keeper behind his counter, the merchant in his warehouse, the farmer in the midst of his live-stock and corn-sacks, the manufacturer amongst his spinning machinery and looms, and the physician or surgeon who ministers to his patient; each and all have laboriously acquired that of which they have to dispose; such disposal being intended to suit both buyer and seller, but still involving a positive "right of property" in the matter, held by one for the use of the other. We suspect that, bringing the question home, Baron Bramwell would himself be obliged to admit that neither the members of the bar, nor the judges on the bench, are wholly adverse to such a view; but that, having acquired something of value by the only practicable means—hard work—they have a "right of property" in their acquirements, which they will use in the best way they can. Is it not the same with the author and inventor with reference to their writings and inventions—their acquired working stock?

It cannot be denied that both the merchant and the professional man, the author and the inventor, have a clear right to keep their goods and their talents to themselves; but if this were the only right which any of them could legitimately exercise, the case would but present a modernised edition of "Love's Labour Lost." But it obviously follows from the notions of the legal debater whose words we have quoted, that the world must be a decided gainer if every one kept every thing to himself. With that we think we may fairly dismiss them from further consideration.

Those who, admitting the rights of inventors, would yet hamper them with restrictions in dealing with what they have at command, can only be regarded as of an antiquated school, the days of which are gone by. The entire feeling of the times is against them. Let us hope that all the simplification which we can make in the legal rights of the inventor, may accomplish something more than the achievement of his right of keeping his available plans to himself; but let us hear no more of the abolition of all chance of a remunerative return for what the inventor creates as it were for the benefit of the world.

In these times the pressing calls for the productions of the inventor, engineering, chemical, manufacturing, or of that wide general class from which new ideas on all manner of subjects are continually floating up, will not permit him to linger; and he has barely time to attempt the supply of the wants of to-day by the more complete and refined researches of to-morrow. His never-ending thought is, "Work now; such and such a thing is wanted; let me see if I cannot accomplish its execution." To do this, he must, and does, bestow careful study upon the annals of past discoveries, thus always imbibing a fresh stimulus to his useful exertions, and learning that most important of lessons, the checking of wild schemes which lead to nothing; remembering, also, that thought begets thought, and that the notion or invention of yesterday must inevitably give birth to a more matured invention of to-morrow. To him research is itself a delight, whilst discovery comes in as the incidental adjunct of his toil. True invention runs in a sublime vein, and we ought to reverence the precious faculty.

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* Page 197, part 164, *P. M. Journal* for November.

Mechanical and engineering progress, affecting the well-being of mankind, is the cardinal fact in the history of this age; and we ought to guard with jealousy the interests of those who, with the heritage of past invention to operate upon so proud a possession so as to continually secure other inventive successes. Each inventor taking his stand on what has been done before, finds it necessary to abridge, to simplify, and to digest the growing immensity of science.

THE ARMSTRONG GUNS.

Sir William Armstrong has at length broken through the reserve that custom has imposed on those in the public service, and in the *Times* of the 27th Nov. has replied to his adversaries, by a letter occupying more than four columns of that broad sheet.

We are glad he has done so, for his own sake, and for that of the public, and we venture to hope, as for the future modifying the tone and manner at least of the attacks that have been made upon him and his artillery. Some of those in cotemporary journals, though loaded with the common cant of profession of all for love of "dear old England," betray personal feeling and motives much less worthy. Both in manner and matter of reply we are bound to say (though no advocates of Sir William, and only desirous of holding even the scales of justice) his reply contrasts very favourably with the attacks of his opponents, and to a great extent, if not completely, we consider him to have sustained his case. Sir William justly says, in an early paragraph of his letter, that —"in the long run the best weapon must win the day, whether it be his or anothers, and he is as sure that his gun cannot be written up into success, as he is that if successful it will never be written down."

This opinion certainly does not appear to be shared in by his opponents, who are also, or rather would wish to be deemed, his rivals (from amongst whom we would always honourably except Whitworth), some of whom at least, together with the organs of publicity, so ungracefully allied with them, plainly act upon the principle, that enough of "iteration," no matter how "damnable," the circulation of mis-statements unexamined and unchallenged as to their accuracy, however often disproved, will not fail at least to "write *them* up" to the point of grasping a slice of pudding before the mendacity becomes "known and read of all men."

We can only afford space for a few quotations from Sir Wm. Armstrong's long letter, and to make some passing remarks. The letter embraces in the main four principal heads of reply to objections, namely, 1. To the guns; 2, to the vent pieces; 3, to the ammunition, and on the score of expense of both guns and ammunition; 4, Captain Halsted's, R.N., special objections. Sir William says:—

"1. First, as to the guns themselves.

"My shortest course will be to exhibit, in a tabulated form, the number of my guns which have been proved and issued for use; the number which have been returned from service for repair; and a few other particulars, all of which I have obtained from official sources. I must crave the patience of your readers for this portion of my letter, which I fear will be too statistical for general interest.

GUNS.

Calibre of Gun.	Number Proved.	Number in Store.	Number Issued for use.	Number Burst.	Number Returned for Repair.	Latest Contract Price.*
6-pounder,	49	44	5	0	0	
12-pounder,	464	152	312	0	14	£120
25-pounder,	325	253	72	0	0	195
40-pounder,	221	48	173	0	2	285
100-pounder,	563	329	234	0	4	650
Total, ...	1622	826	796	0	20	

* The Government being guaranteed against injuries at proof.

"The above table extends over the whole period that has elapsed since the adoption of the gun, and I proceed to make some comment on it.

"I will, however, first speak of a gun said to have burst, though bursting is not the proper term to give to the fate which befell it. It had been used for drill the night before, and left by mistake with the drill or practice shot still in the muzzle. On the next day the gun was loaded at the breech, and fired in ignorance of the oversight, when the muzzle, as a necessary consequence, was blown off at the point where the practice shot rested. Both shots were recovered, bruised and fractured by the collision, showing plainly how the fragments of the one had acted as wedges to jam the other. These circumstances were notorious at Shoeburyness, where the accident happened, and it is remarkable that the occurrence should have transpired in the *Mechanics' Magazine* shorn of its explanation. As the muzzle of any gun that human ingenuity ever invented would have been blown off under similar circumstances, I think I may fairly conclude that the 40-pounder lost its muzzle without losing its honour."

Sir William then enters into several explanatory particulars relative to the guns "returned for repair" in the 6th column, and disposes of the greater number in various ways that any unprejudiced man must admit leaves no slur, under this head, upon his designs or carrying into practice. He proceeds:—

"2. I now come to the statistics regarding the vent-pieces.

"Before entering on this branch of my subject, I may remark generally, that the vent-piece is not expected to have the same durability as the gun. It is separate from the gun, and contains the vent or touch-hole, which is the most perishable part of all ordnance. Every time the weapon is loaded the vent-piece is removed; two of them are attached to each gun, and if one is injured by casualty or wear of the vent the other is ready to replace it. A list of injured vent pieces is, therefore, not a list of accidents. The list below comprises not merely broken vent-pieces—indeed, a wrought-iron vent piece has never yet been known to break—it is made up of vent-pieces worn in long and honourable service, as well as of those broken, bulged, cracked, flawed, or rendered unserviceable in any other way."

And we have the following tabular statement of all the know casualties:—

VENT-PIECES.

Calibre of Gun.	Number Issued (Two to each Gun issued.)	Number blown away.	Number rendered Unserviceable	
			Steel.	Iron.
6-pounder, ...	10	2	0	0
12-pounder, ...	624	2	8	0
25-pounder, ...	144	0	3	0
40-pounder, ...	346	1	9	7
100-pounder, ...	468	0	4	1
Total, ...	1592	5	24	8

"A few remarks are necessary as to this table, which, like the former, extends over the whole existence of the gun in the service."

He then goes into a number of special explanations as to actual circumstances attending most of these "blown away" vent-pieces, and quotes from an official report, dated 14th November, 1861, ordered by the Solicitor-General of Ordnance, the final exculpatory dictum—"*they always arise from carelessness.*" He is also able successfully to impugn some of the facts stated by Captain Halsted, R.N., on this part of the subject.

We have ourselves always been, and we still are, of opinion, that the vent-piece, including in that all the arrangements for breech-loading, are the really objectionable points of Sir Wm. Armstrong's guns. We hold breech-loading guns, except for certain special services, as altogether a mistake—a needless introduction of complication and of weakness, attended with a train of difficulties and dangers in handling and use—and without any adequate end attained, unless for such special cases. What these may be, it is not now our purpose to show. We even now, in the face of what Sir William, Whitworth, Clay, and others, have already achieved, are ready to endorse the opinion of Sir John Burgoyne, uttered as long ago as 1853 or 1854, and to predict that ultimately it will be found, that for most purposes of military and naval warfare, "a muzzle-loading rifled gun, provided with a running shot, that shall be easily rammed home, and shall yet expand at the moment of discharge, so as to stop all windage, is what is wanted." We must even go somewhat further away from Sir William's views, and add, that for all small guns, say up to 24-pounders at least—possibly for even larger ones—we believe Mr Clay's breech-loading arrangement a simpler, better, and safer one than his, when breech loading may be required.

Per contra, when we call to mind the brutish awkwardness and ignorance of mechanical arrangement, and of the logic of cause and effect, commonly shown by artillerymen, and even seamen, in the handling and adjustment of things so entirely new to them as breech-loading rifled guns, it does speak most favourably of the general adequacy and efficiency of Sir Wm. Armstrong's breech arrangements that the accidents have been so few, and that these few admit of the explanations given by him, the details of which we regret we cannot here recite. We must not, however, exclude the following passage, as proving conclusively how much carelessness—or possibly even something more discreditable still—has been concerned in such failures as have occurred:—

"As to the failures of the wrought-iron vent-pieces. In the case of the 100-pounders, they are limited to the single instance of a vent-piece slightly bulged, which had not been reported when I last addressed you. Beyond this, we have but seven to account for. As I have above said, all these seven occurred to one class of gun, whose pattern of vent-piece will in consequence now be changed. But, what is more remarkable, all these seven (together with the four vent-pieces mentioned above) failed on board the *Trusty* in the course of a single experiment with Captain Cole's cupola shield, during only 142 rounds from only two guns. The gun in which eight of the 11 vent-pieces thus failed was brought to Woolwich for investigation. It there exhibited none of the destructive qualities it had shown on board the *Trusty*, but was fired 58 rounds with the same pattern vent-piece as before, yet could make no impression on it. Failures so singularly localized can only have arisen from some special cause. At the same time the strengthened pattern will meet even such contingencies as these."

Somewhat unnecessarily, as it appears to us, and with some *little* symptom of "blowing his own trumpet," Sir William then goes into a good deal of detail as to the "complicated system of fuzes and projectiles" that he has had to introduce and perfect with his guns.

This is just the point upon which, were we here called upon to discuss it fully, we should have in much to disagree with him. We believe his elongated shell-shot against any rampart capable of making a really stout resistance, and not a mere sham, such as that of the much-vaunted *brick* Martello tower, "cut through and through"—no doubt as you might cut so much cheese—will never be the efficient battering projectile that round solid shot, and still more very large spherical shells, have proved to be. We hold that his segment shell will never prove a satisfactory weapon under any circumstances, and for deadly effect against troops will be found immeasurably inferior to Boxer's diaphragm-shrapnel shell. We cannot here attempt to give our reasons; but we may hint to those competent to follow the subject, to investigate for themselves the nature of the trajectory paths that must be described within the "cone of dispersion" by the irregular fragments of Armstrong's *elongated* segment shell, and by the bullets and fragments of the Boxer-shrapnel.

Again, we apprehend it must prove to be *practically* a fact, that the elongated Armstrong shell *cannot* be used as a Martin shell, filled with molten iron. We do not say it is physically impossible; but we do say it will prove so delicate and ticklish and dangerous an operation as to be unfit for the "rough and ready" of actual service before an enemy; and we are strengthened in this opinion from seeing the results of these Martin-Armstrong shells as actually fired within a week or so at Woolwich. It appears that each Armstrong shell was lined with a non-conducting material, *i.e.*, with an internal coating of a cream of fire-clay and coke dust, or something of the sort (like a foundry ladle) dried in them to prevent the spread of the heat through the shell. If this be so, and be essential, it seems conclusively condemnatory; such a lining can only be applied and dried within the shell (its uniform covering and adherence to which will be always matter of uncertainty, though of vital importance) by special apparatus which cannot be of a portable or very simple character; and the shells themselves, when so lined, ready to fill with the liquid iron, will not bear carriage without shaking the lining out or off. So the lining must be applied, and dried at the gun, and in face of the enemy.

In a word, for every purpose to which a shell can be applied, an elongated one, approximating to a cylinder, will be found greatly inferior to those of a spherical form; and as regards the partial division of the shell into segments, so as to insure its breaking into a greater number, and of more equal fragments, we may remark in passing, that Mr Mallet patented a spherical shell with this improvement, and the modes of casting it before Sir Wm. Armstrong ever brought forward his segment shell. Both are identical in principle and object, and the spherical shell, for equal weights of powder, by much the more powerful weapon.

Passing from his partial digression, "*in laudem*," his own ammunition, Sir William gives a number of instances of the resisting powers and endurance of his guns; and with his first sentence of the paragraph subjoined, we wholly agree. His guns *are* so far of unprecedented strength, and the objections taken to their formation, *wholly* of wrought-iron, and recommendations to make the internal tube of steel, or of cast-iron as better in principle, only prove the quackery and sciolism of the utterers; but we cannot discuss the point now.

"The truth is, that the guns are of unprecedented strength. Your readers will be interested in an account of some official tests of endurance to which one 100-pounder, two 40-pounders, and two 12-pounders not long ago were submitted. The facts have been in some measure made public, but will, I think, bear repetition.

"The 100-pounder (weighing only 81 cwt) was fired 100 consecutive rounds with the full-service charge of 14 lb. The projectile for the first ten rounds was of 100 lb. weight, and was increased by 100 lb. every ten rounds after; so that from the 90th to the 100th round it weighed 1000 lb., and projected two feet from the muzzle. The gun, after sustaining this extraordinary test without injury, might have been merely passed into the service, but was taken for the severe duty of proving vent-pieces, and daily endures a repetition of full-proof or double-service charges of 28 lb.

"The two 40-pounders (weighing 32 cwt. each) were loaded with full-service charges of 5 lb., and fired, like the 100-pounder, for 100 consecutive rounds. In the first instance the projectile was 40 lb., and it increased in the same manner every ten rounds up to 400 lb. Both guns remained uninjured; and at the close of the experiment it was determined to try one of them still further. It was fired for 30 more consecutive rounds, but this time with double charges of 10 lb. The projectile ranged as before, between 40 lb. and 400 lb., every third round receiving an additional 40 lb. in weight. These two guns, like the former one, are uninjured, and are still, for all I know, in regular use.

"The two 12-pounders have nearly the same story to tell. I will not, therefore weary you with the details at length. Both withstood the hundred consecutive rounds, with proportionately increasing projectiles and full-service charges of 1½ lb. Both were submitted to the double proof charges of 30 rounds more. One remained perfectly serviceable and sound, the other failed near the muzzle, after the sixth increase in weight of the projectile—that is to say, after throwing a cylinder of 84 lb. with double the service charge. But I must observe that in choosing these two 12-pounders for this ordeal, one was purposely selected which had actually been rejected at proof as defective; and it was this defective one which finally succumbed to the treatment I have described.

"But, after all, special experiments of endurance are hardly of more value than the general experience gained in ordinary use. I select from the list before me some returns of the number of rounds fired by individual guns which are still in constant practice. Of heavy guns, I see that one 40-pounder has fired 721 rounds, another 571. Of the 12-pounders, one has fired 1720 rounds, another 1832, another 2817 rounds. Even my original experimental 18-pounder gun, submitted to the Government in the year 1857, has fired between 2000 and 3000 rounds, and is still in perfect condition."

Nearly the last third of Sir W. Armstrong's letter is devoted to reply to the attacks made upon his guns by Captain Halsted, R N. He chooses this opponent not, perhaps, as more formidable, but, as is pretty plain, because, right or wrong, he respects the bluff and honest sailor, and has an equivalent contempt for others whose motives make them less worthy of his lance. Sir William says—"After the ample statistics I have given I might close my letter here, but I will first shortly notice some specific strictures on my guns which have lately appeared in the public newspapers, and, as I prefer an opponent, however uncompromising, who has the manliness to avow his name, Captain Halsted shall have the precedence." We must omit the main mass of arguments by which, upon the whole, successfully as it appears to us, he disposes of the gallant sailor's "bill of particulars." We can only find room for the wind-up:—

"I now arrive at his summary of 'inherent defects,' which I shall very quickly dispose of.

"1. He says, 'the gun cannot be loaded at the muzzle.' I might as reasonably object to a muzzle-loading gun, that it cannot be loaded at the breech; if, however, it be an object, which I do not concede, to have the alternative of loading at the muzzle, I need only rifle my breech-loader on my shunt system, and it becomes a muzzle-loader also. The gun which fired the other day 51 rounds at the rate of one in 26 seconds was a gun of that kind.

"2. He says, 'the gun cannot be double shotted.' There is not the least difficulty in using two flat-ended shot; but why should this be done when a single percussion shell would be ten times more effective?

"3. He says the gun cannot throw an incendiary (Martin's) shell. Here he is utterly wrong, for even the lead-covered shell, to say nothing of the ribbed one, has been successfully fired with molten iron in both 40-pounders and 100-pounders; in fact, targets are at present being built for a continuance of the practice.

"4 He alleges that the gun 'cannot be used with reduced charges for fear of the effects of air space.' If Captain Halsted had attended the ricochet firing at Woolwich, he would have seen all sizes of my guns, from 40-pounders downwards, used with every variety of charge, from a few ounces up to the full service quantity.

"5. He declares that, 'within certain limits of distance the gun cannot be used to cover either troops or boats with shot or shell, for fear of the lead which strips from all the projectiles, as proved on service in China, and as openly admitted by the author himself in May last.' Really I thought that, on the occasion to which Captain Halsted so strangely refers, I had succeeded in showing the hollowness and absurdity of this objection. I stated that the lead could be, and had been so absolutely fixed to the projectile as to render separation impossible. I produced specimens of shells, both exploded and entire, in proof of this. I showed that the military authorities had had their choice whether the lead should be thus absolutely fixed, or be in some degree separable, so as to produce more fragments on the bursting of the shell. They have made their choice, and must be considered the best judges of what are the requirements of the service. If Captain Halsted can persuade them that they have chosen wrong, it is open to them to modify their decision in any way they please; but as they have been offered any degree of adhesion, I do not see how I can be responsible for their decision, though I believe they have decided rightly."

There is one paragraph, however, of this part of the letter, which we have rather over-passed, on which we return for a moment. It is as follows:—

"Captain Halsted asserts, that, 'up to the present time, the 100-pounder gun has never been subjected to any representation of real action by 50 consecutive rounds of rapid fire.' This is incorrect. All descriptions of my guns have been fired 50 rounds at a time continuously, with various degrees of rapidity."

We must say Sir William Armstrong's rejoinder upon this point conveys to us an unfavourable impression—one that we should wish, if possible to be freed from. It looks "diplomatic." He would *convey*, but he does not boldly assert, that his 100-pounder gun has ever been fired 50 rounds as fast as if in hot action. Now, if it be the fact that, at the date of his letter, 27th November last, what he thus conveys was literally the fact, how comes it that, since that date, we find that a special set of experiments have been made at the butts at Woolwich, "when two 100 pounder Armstrong guns were each fired 50 rounds, consecutively, in a time" not exceeding forty minutes—if 100-pounders were included before amongst the "all descriptions" of guns, and the "various degrees of rapidity" included 50 rounds so fast as in 40 minutes or less, whence the necessity now to have specially made or repeated the trial? If we misinterpret Sir William in this, let us, by anticipation, tender him our apology; but if not, let us advise him to take no leaf, nor letter, out of the book of his disingenuous adversaries.

We must, however, conclude with but one more quotation, which forms almost the conclusion of Sir William's long epistle:—

"But there are some objections—by far the most loudly and persistently repeated—which come from more disingenuous assailants. Statements absolutely false, contradicted officially by ministers in Parliament, and by myself, as author of the gun, are adduced again and again, whenever the refutation is likely either not to have been seen or to have been forgotten. For instance, despite the most authoritative denials, it is asserted and reasserted that the guns failed in China, and that casualties occurred from the stripping of the lead. One paper, the *Mechanics' Magazine*—into whose motives for continual misrepresentation I do not trouble myself to inquire—on the 1st of March last actually presented its readers with an imaginary summary (pointed with marks of quotation) of a 'confidential despatch' sent home by Major Hay, in which the gun was said to have been spoken of in condemnatory terms, to have been withdrawn from action at a critical moment, and to have occasioned casualties to our men. It further informed its readers—not for the first time—that the average cost of the guns was £2000. Mr Baring, Under-Secretary for War, gave a flat denial to all these statements from his place in Parliament, on the 14th of March last. 'No casualties occurred' in China, and Major Hay's report was of a directly opposite nature. 'The gun,' says Major Hay, 'was the admiration of all.' Mr Baring further told the House that the price of the 12-pounder and 40-pounder Armstrong guns was £120 and £285 respectively. In spite of all these rebuffs—in spite of Lord Herbert's declaration, founded on the China despatches, that 'we had the best gun in the world'—in spite of the testimony to its efficiency and value given on every public occasion by the Commander-in-Chief of the expedition—in spite of Major Hay's published letter to myself, which I subjoin, the *Mechanics' Magazine* insinuated, and still insinuates, that the Government 'suppressed' the truth; that Major Hay's despatch had been written in the sense they had affirmed, and that Government influence was used to prevent China officers from speaking. In their number of the 18th ult. I find this strange statement, the disingenuousness of which is quite monstrous:—'Mr Baring, the Under-Secretary for War, in his elaborate speech on the War Estimates, showed that each Armstrong gun had cost on an average £2160, thus proving that we were sufficiently guarded in our statements.' I feel slow to impute animus to anybody, far less to a journal which represents mechanicians, but I am compelled to speak strongly about misstatements so deliberate and so repeated.

"From such attacks as these I appeal to common sense. Vague and groundless insinuations, thrown out by random writers, who may, for anything I know, be unscrupulous as well as misinformed, should not be allowed to excite public alarm. It is said that there ought to be a Committee of Inquiry." And Sir William goes on to inform us that, in the Ordnance Select Committee at Woolwich, such a committee is perpetually sitting upon his inventions and improvements.

We can only say to this amusing proposition, *risum teneatis amici*—that committee, the sign over whose door—if it were not *infra dig* for them to exhibit one—ought to be "Inventions taken in and *done for*," that originating nothing, promoting nothing, however valuable and important, that comes before it—stifling all that is new, because it is so, unless its merits chance, in the end, to stifle them—and whose "custom of the service" and sole occupation it is, and ever has been, to evade, and set aside, and get rid of, by the easiest methods, and at the least trouble, everything that, entering the war department as good and new, has to pass through that unhappy intellectual sieve!

Sir William has passed the sieve. The meshes look small in his eyes, and, no doubt deem themselves so; and his "permanent Committee of Inquiry" is an eminently complacent one. We do not say any committee of inquiry is requisite, unless it be on one ground—that of the cost to the public of the whole ("personel" and "materiel") system by which Armstrong guns are supplied. On this point, notwithstanding Sir William's final statements, which we have quoted, we have our doubts. Whenever any man places himself in the double position occupied by Sir William Armstrong, and in which he has so unluckily been placed by Government—at once a contractor at Elswick and a director at Woolwich—seller and buyer in trust for the public combined in his own person—he may rest assured that, however falsely or unjustly, suspicion, and public distrust, and belief in extravagances that may be wholly imaginary, must continue to beset him and the Government department that so employs him

If we are to have a Committee of Inquiry, let it be a Committee of the House of Commons. Our own belief is, that thoroughly sifted before such a tribunal a very large proportion of alleged and charged extravagance would vanish into thin air. The magnificent train of machinery at Woolwich by which these guns are now made with such exquisite precision has not been produced without swallowing up an enormous capital, the whole of which, we observe now and then, charged to the cost of the Armstrong guns up to this time produced—as well value a loaf of bread by the cost of the mill that ground the flour. Very much of the design, perfection, and completeness of this noble train of machinery we believe is due to a gentleman whose name is less associated with the *eclat* of Armstrong guns than it deserves. We allude to Mr Anderson, C. E., Deputy-Director of Gun Factories at Woolwich.

SUBTERRANEAN RAILWAYS IN THE METROPOLIS.

LONDON residents and London visitors will very shortly be in possession of a most important accession to their comforts, in the guise of a complete ramification of tunnelled or subterranean lines of railway, affording a rapid and safe means of communication between the most distant parts of the wondrous city, without touching the now tremendously overcrowded streets. The project has been long talked of, and long held to be an impossibility; but, with the gradual disappearance of that word before the advance of practical knowledge, the idea has at length developed itself in a real, veritable form, and the first length of line, from the Victoria Street Station to Paddington, is to be opened prior to the 1st of May next, when it will, of course, bloom as a useful show for the Exhibition visitors.

Although what has been accomplished is termed "subterranean," it is really not properly or entirely so, as nearly half the length we have mentioned is above ground or open to daylight, and the intervening lengths of tunnels are spacious and well-lighted with gas, looking as much like a surface street by night as anything else. Hence, the disagreeables which we are prone to picture as inseparable from a railway running right through the deleterious subsoil of London are really by no means so dark as fancy has made them. The joint stock company, under whom the engineer, Mr John Fowler, has worked in the matter, have, so far, only obtained powers for the construction of their line from Paddington to Finsbury Circus, a length of four miles and a half, so that, deducting the three miles already connecting the margin of London at Paddington with the central portion at the Victoria Street Station, and having perfect working junctions with the Great Western and Northern Railways, there remains but one and a half miles to make.

The direction of the line, as it leaves the Paddington Station, is in a nearly straight line towards the New Road, passing beneath the Edgware Road, at right angles thereto, and similarly intersecting Lisson-Grove Road and Upper Baker Street, and then skirting beneath, and just outside, the southern margin of Regent's Park Thence it passes beneath the eastern end of Park Crescent—in which its burrowing has partially injured several houses—continuing beneath Tottenham-Court Road, into the New Road, and passing close by Euston Square, turning up at King's Cross to form a junction with both the up and down lines of the Great Northern railway. With the exception of about 600 yards beneath Bagnigge-Wells Road and Coppice Row, which is, of course, tunnelled, a great portion of the length eastward from King's Cross is an open cutting. From this point to the Victoria Station it is nearly all open cutting. The whole of this length of the works is nearly ready for use.

The wretched plague-spot-looking ground at the east end of Holborn, bearing the singularly inappropriate name of Victoria street, is intended as the site of the Victoria Street Station of the new line, yet to be built. Two branches will shortly be made from here, one to intersect Skinner Street, and to run southwards beneath the old Fleet Prison, to join the Chatham and Dover line, intended to cross the Thames at Blackfriars. The other and far more important branch, as concerns London itself, and which branch is really a section of the main line, runs eastwards beneath the ground, north of Smithfield, and South of Charter-House Square, passing under Barbican directly into Finsbury Circus, where, for the present, it will come to a stop, with the intention, however, of hereafter ramifying into all the chief suburban districts of the dense eastern end of London. Even as it is, the nitra-mural connection of the different main railways running into and out of London, quite independent of all London streets, will secure what will soon be felt as marvellous facilities in the way of rapid and convenient travelling. For example, all travellers from the extreme northern counties of Scotland and England, as well as the vastly important midland counties, will be enabled, if need be, to book and travel directly on-to the great stations for sea-going, Dover, Folkestone, and Southampton, without even a momentary delay, whilst persons coming up to town from Dover or Brighton will be enabled to reach almost their very doors at the West End, entirely avoiding the break, and the dreadful street journey through the narrow and continually blocked-up thoroughfares, which, to many travellers, is always felt as a more intolerable matter than the actual railway trip itself.

To the Victoria Street station the line is nearly 3½ miles long, having stations at Paddington, Edgware Road, Baker Street, Portland Road, Euston Square, King's Cross, and Victoria Street. From west to east the average slope downwards of the whole line is about 1 in 300 feet, though after entering the city, it again rises, but there is no steeper gradient throughout than 1 in 100. Its greatest curve is of 200 yards radius, and its greatest depth from the ground above, to the rails not less than 54 feet, and there are not more than 1200 yards of straight line throughout. The span of the arch of the tunnel is 28½ feet, its form is elliptical, and its height 17 feet, except in the parts where there is great superincumbent pressure, when the form of the arch is altered to give it greater strength, and to take the crown to a height of 19 feet. The foundations of the tunnel go from four to five feet into the solid ground on each side below the rails, except in some few places, where the close vicinity of very heavy buildings rendered extra strength necessary, and here the tunnel has been driven like a shaft, and is a solid ring of massive brickwork above and below; in fact, in all parts of the tunnel itself the most zealous care has been taken to insure the structure being everywhere greatly in excess of the strength it actually requires. Thus, even the lightest parts of the tunnel have six rings of brickwork, though railway arches of seven feet greater span are never built with more than five. The outer sides of the arches also are filled in with solid beds of concrete, and the whole is covered over with a layer of asphalte to keep it water-tight. In fact, the tunnel has been formed on what is called in engineering phraseology the "cut and cover" principle; that is, the ground has been opened to the base of the intended tunnel, the tunnel built, covered with concrete and asphalte, and filled in again with earth, and the roadway paved over as before. On this plan, and working in 12ft. lengths, the tunnel has actually been constructed at the rate of 72ft. a week, quicker than any work of the kind has ever yet been accomplished.

In the neighbourhood of churches and large structures the tunnelling has been driven in true mining style, in four feet lengths, and at such parts the works have necessarily got on but slowly. In the western sections, where a fine gravelly soil largely prevails, water was a great obstacle, as it was everywhere found as near the surface as fourteen feet from the natural level of the earth. Pumping would not do, as the mass of sand and gravel brought up, not only ruined the action of the pumps, but also threatened to carry away the very foundations of the superincumbent buildings. The only remedy was the making regular drainage ducts into the low level sewers, and by this means only, costly as it must have been, were the workings kept free. A double line of broad and narrow gauges as used under the disjointed circumstances of our great rails has been executed throughout, and each line embodies both the railways: this is a most important consideration. At the junctions at Paddington and King's Cross, the tunnels are widened to allow of the proper connection of the switch rails. This has proved to be the most difficult task ever accomplished either in actual tunnelling or brickwork arching; but Mr Fowler has most successfully done what he attempted.

The great Fleet Ditch Sewer crosses the new line directly through the crown of the tunnel arch, and as it obviously could not be disturbed, the difficulty was attacked and overcome by slinging the sewer across in a cast-iron trough so as to convey all the noisome matter of that ancient and historically connected duct—once, alas, a clear rivulet—clear away, for its very existence in such close proximity is now utterly ignored. Mr Jay is the contractor for all the works at this end of the line, from Euston Square, and he has made an excellent piece of work of all he has undertaken.

The stations along the line which we have just described, are, with the exception of two, all open-air ones, and those which are beneath the earth's level are well lighted, through openings in the roof of the arch. So much for the permanent way. That settled, it became a question as to how it was to be worked so as to avoid the objections to an ordinary locomotive steam engine. Power and speed were both wanted; but how to obtain these requisites without discharging smoke, and worse still, waste steam into the shut-up tunnel, opened up matter for grave consideration. With a common locomotive, a suffocating atmosphere would be produced to such an extent as would almost, if not entirely, defeat the great object of the promoters—the obtainment of pleasant travelling. A new arrangement of engine was therefore required, and Mr Fowler has succeeded in producing one which operates like an ordinary one in the open-air, but which evolves no smoke, and condenses its own steam when under way in the tunnel. This engine has been practically tested on the finished portion of the line with signal success.

It is intended to start the through trains from east to west, and *vice versa* every ten minutes, the journey to be performed in thirteen minutes, the fares being low enough to compete with the cheapest omnibuses. On the whole, we think that if travellers in and through London are not satisfied with the great advantages thus conferred, they will be hard indeed to please.

SMITHFIELD CLUB CATTLE AND IMPLEMENT SHOW—1861.

The glory of Baker Street is departed—the last of a long series of annual shows of highly-fed and well-bred live stock, with the most approved appliances for facilitating operations of farming, from steam cultivation to pig-feeding, has been successfully brought to a close; but only to reappear next year with fresh life and vigour in a more capacious and suitable structure.

The display of implements this year, though extensive and instructive, is not marked with many novelties. Commencing our survey with the heavy department, we noticed a considerable influx of "tractions," as our agricultural friends laconically term them. These useful engines are working their way slowly, perhaps, but none the less steadily, into the hearts of our high farmers. Our old friend, Mr Thomas Aveling, of Rochester, exhibits a well-made specimen of his traction-engine, the driving wheels being rotated by an endless chain from an intermediate shaft—a simple contrivance being adopted for taking up the slack of the chain and throwing the locomotive gear in or out of action. The simplicity and cheapness of the steering apparatus are strong recommendations in favour of Mr Aveling's engine, a simple knife-edged swivel wheel, and a lever arm being made to answer all the requirements of the comparatively complicated gearing adopted by other makers. Messrs Gardiner & Mackintosh, of the Railway Foundry, New Cross, exhibit a 12-horse traction engine with endless driving chain, and an ingenious eccentric movement for tightening the chain. The steering is effected by means of a pinion gearing into a toothed segment on the fore locking axle of the engine. Taplin & Co., of Lincoln, also contribute a 12-horse traction engine, of a very similar construction to Aveling's, but they drive from a very small pinion on the crank shaft, in place of from a larger one on an intermediate shaft, which is not to our mind so practical a mode of driving as Aveling's, as the chain is too much pinched in passing round the pinion, which is of very small diameter, and is therefore more liable to become deranged. The chain is tightened by adjusting the axle-box of the main axle by set screws so as to move it further back from the crank shaft. An elevating screw is placed under the fore part of the boiler for the purpose of adjusting the same so as to maintain it as nearly as possible in a horizontal position when passing over heavy gradients. In a 12-horse traction engine exhibited by Robey & Co. of Lincoln, the driving pinion is carried on the crank shaft immediately above the main axle, and the chain is tightened by simply raising the boiler. A corn elevator, recently patented by W. S. Underhill, is exhibited, applied to one of Clayton & Shuttleworth's trashing machines, and gives general satisfaction. It is a most simple contrivance for effecting what has hitherto required a rather complicated arrangement of mechanism. This elevator, blower and cleaner—for it combines the properties of all three—consists of a fan revolving inside a casing, which is supplied with three moveable plates, namely, a smooth plate for every description of grain that requires but little dressing—a "nob'd" one for barley, which is difficult to horn, and a fluted plate for grain that requires hard rubbing. The grain to be operated upon is directed into the casing, and is subjected to the beating action of the fans, and the friction of the plates, and is finally elevated by being blown up a tube or elevating spout by the blast generated by the rotatting fans. To give an idea of the importance of this simple contrivance, we may here state that it is capable of lifting any quantity of grain any height without the use of the ordinary tins—it dresses the corn in its passage to the separating screen, and when applied to thrashing machines, it obviates the necessity for a second blower, and thereby greatly simplifies the machine by dispensing with four driving straps and eight pulleys. We were much pleased with a combined thrashing machine exhibited and manufactured by Nalder & Nalder of Challow Works, Wantage, Berks. The Messrs Nalder have evidently devoted particular attention to this class of farm implements, and have succeeded in producing one of the best, if not *the* best and simplest thrashing machine in the market. The one exhibited by them contains we should say nearly *fifty per cent.* fewer wearing parts than most others of equal capabilities, the advantage of which is at once obvious. This great saving of wear is obtained by suspending all the reciprocatory parts such as shakers, shogging boards, caving and winnowing riddles, on *elastic joints*, or flat wooden blade springs, which are securely fixed at one end to a stationary bracket or clip, and at the other or free end to the parts to be reciprocated; hence all friction of working parts is avoided. The cavings, chaff, and corn are all well separated, and are moreover delivered at such intervals as to obviate all chance of their becoming again united. The straw is delivered at one end of the machine, and the chaff is blown into the general hulk of chaff near the opposite end thereof, instead of as in many cases amongst the straw. The corn is delivered at the end farthest from the straw, and the cavings fall from near the centre of the machine. The whole of the operations of thrashing, winnowing, &c., are conducted *inside* the framing of the machine, so that the corn, when once put into the drum, is not again exposed to the weather, and the cavings and chaff, by falling *under* the machine, are protected from wet in case of a shower. On the end of the barley horner is attached "Nalder's patent *whitecoater*," which effectually rubs off all husks from wheat, and generally improves the sample. The elevators are fixed inside the framing, and are so arranged as not to require moving when travelling. The machine is placed on high wooden travelling wheels set near together, thereby rendering them easy of removal from place to place. The makers estimate a saving of fully *twenty-five per cent.* in fuel by the use of this machine, by reason of the great reduction of friction and direct action of the working parts. Mr Edwin Moore exhibits a simple contrivance (some time before the public, however,) for sharpening knives, scissors, &c, consisting of two steel cutters set at an angle, between which the blade to be sharpened is drawn. It is no doubt effective; but how about the wear and tear on the blade?

We noticed at the stand of Messrs Tasker & Sons a well-made model of a new windlass for steam ploughing, in which the driving gear, which is constructed on the principle of the sun and planet motion, is contained within the drums. It is a most ingenious arrangement, and from its compactness and power, and the protection afforded to the gearing by being inclosed in the manner described, is well worthy the attention of all who use steam power in cultivating the soil.

Messrs Maggs & Hindley of Bourton, Dorset, exhibit a self-expanding block chain harrow, which is said to be a most efficient implement for clearing couch from the ground after the scarifier, harrowing before the drill, covering in seed, dressing young wheat, or working in manure on grass land. This harrow consists of a number of iron blocks linked together so as to enable them to adapt themselves to the irregularities in the surface of the ground, and provided with teeth or tines on one side, and rubbers on the other, so that either side of the harrow may be used.

Weston's patent differential pulley blocks appear to be sought after, judging from the number of stands where they are exhibited. They are an exceedingly simple contrivance for raising, lowering, and supporting heavy weights, and will be found most useful on a large farm. The upper or fixed block is provided with a double sheave of unequal diameters, having niches gearing into the chain, which hangs from it in two loops, in either of which is placed the single or lower block attached to the weight to be hoisted. As one sheave in the upper block is larger than the other, and both sheaves (being made in one piece) revolve at the same speed together, it follows that the larger sheave takes up more chain at each revolution than the small one, and *vice versa*, and the weight is necessarily raised or lowered in proportion A weight suspended from the single block has no tendency to run back, from the fact of the opposite sides of the loop pulling against each other on the opposite sides of the upper double sheave.

We noticed another novelty from Canada, which has already supplied us with a digging machine and rotating harrows (neither of which, by the way, did we see at this year's show) in the shape of a combined plough, drill, and harrow, the invention of Mr Sovereign, of Western Canada, where it has, we are informed, given general satisfaction. This implement is provided with a set of five steel ploughs, made to work at any depth and breadth, a seed-box and set of drills, a manure box, and a chain harrow at the rear. It weighs about 6 cwt, and is said to be capable of being worked by a pair of horses By this implement it is proposed to plough, sow seeds, deposit manure, and harrow at one operation. How far it is judicious thus to risk, by combining so much in one machine, appears questionable.

Benjamin Fowler & Co., exhibit,as they always do, an extensive assortment of pumps and other water elevating appliances, amongst which we noticed an excellent hydraulic wheel for irrigating purposes, intended for use in India. It is the ancient Persian wheel, in iron, with modern proportions and construction.

Glover's circular sheep crib is a useful article for feeding sheep in the field. The crip or feed trough is of a concave form, and is covered or roofed in by a concave cover of galvanized iron projecting a few inches beyond the circumference of the crib. By being made concave or dished on its upper surface, the rain water, in the case of a shower, does not drip from its edges or caves on to the sheep whilst feeding, as is the case with covers made convex on their upper surfaces, but is carried off down a central drain pipe underneath the crib, the concave cover acting as a funnel for collecting the rain water and directing it down the central drain pipe. These cribs are very portable, and will be found well worthy the attention of flock masters.

A small working model of Clay's patent cultivator for steam power deserves notice. This implement is constructed to run upon a pair of wooden wheels, placed in the centre of a frame, and capable of being easily turned to an angle with the frame by means of a lever; the principal weight being thus supported upon the guide wheels, the implement can be readily steered in any desired direction. The tines are self-acting, and are fixed with clamps to a double series of revolving bars in such a manner that as one set of tines are put into work by a connecting rod, they raise the other set out of the soil; the one set working in an opposite direction to the other, and hence the necessity for turning the implement at the headland is obviated. The number of the tines may be increased or diminished at pleasure, and may be adapted for any kind of work, whether broadsharing, cultivating, or grubbing—they may all be readily adapted to light or strong soils.

We conclude our rapid survey of objects noticed, not inaptly, with one of the latest novelties in steam cultivation, recently patented by the indefatigable Mr Smith, of Woolston, namely a combined steam cultivator and seed drill, for drilling and cultivating at one operation. Mr Smith exhibits only a drawing of his implement, as he is anxious to test it thoroughly before introducing it to the public—a few others would do well to follow Mr Smith's example.

We have said that there is no striking novelty in this year's exhibition. Viewed as a whole, however, one is struck with the evidences of increased constructive care, and more finished perfection as to important details displayed by most of the implements. This very generally extends deeper than the mere paint and varnish that belong to work for "the show."

There is yet, however, endless room for invention; ability still to be employed upon further improving the details even of the latest and most advanced machines of the heavier classes. Springs remain to be efficiently applied to all road or field tractive engines; more effective means of maintaining the water level of the boiler in hilly countries are needed, and other matters, which did space permit, we should advert to.

The conviction is forced upon the observer here, and at similar exhibitions, that agricultural implement making, from having been one of the rudest of trades, has become an affiliated branch of mechanical engineering, as agriculture itself, in its greater operations, has taken to itself the applications of every science, even the most refined, and become a branch of civil engineering. Both may point already to great achievements; before their united efforts, expands a great and boundless future; already, in Great Britain alone, there is said to be more than four hundred steam ploughs or cultivators at work.

Not ten years ago, one of our best informed men of science, Professor Lloyd, D.D., remarked in an inaugural lecture at the school of engineering of Trinity College, Dublin, "That it was a striking fact, that up to that time no successful means had been devised of directly mitigating the (so-called) curse of labour, by the substitution of mechanical for animal exertion in the labouring of the soil." Any churchman who should now rest a theological inference upon such a basis, would already find himself in the class to which the Anti-Galilean doctors have been consigned.

Steam agriculture may yet show triumphs in "the relief of man's estate" greater than those of locomotion by sea and land. Great and foremost in time these have been in England; yet not greatest, nor ever to be fully developed, in our little, fenced, and hedge-rowed and hilly island. In the great Germanic plain of Central Europe—upon the broad-spread and deep loam of India, and upon the boundless surface of American prairies, "wide as Old England," and level as an ocean, will the steam plough show its fullest powers, and make the earth teem with plenty for man and beast in the ages to come, with an abundance, as compared to which our "gathering into barns" of to-day shall seem but as famine.

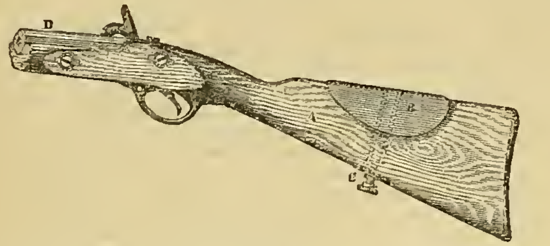
RECENT PATENTS.

FIRE ARMS.

Alexander Henry, *Edinburgh.—Patent, dated April 22d*, 1861.

This invention relates to the arrangement and construction of the stocks of rifles and other generally similar arms, also in sights for the same, and in moulds for casting projectiles to be used therewith. Fig. 1 of the accompanying engravings is an elevation of a portion of a gun, showing the patentee's improved cheek plate applied thereto. The stock, A, of the gun has fitted to it a metal plate, B, which is curved and shaped to the form of the part of the stock on which it rests so as to fit closely thereto. The plate, B, may be covered with leather, or it may be made smooth and browned like the barrel.

Fig. 1.



To the under side of the check plate, B, is attached a flanged tube, the position of which is indicated by dotted lines in the engraving; this tube forms an internal screw and is fitted in a correspondingly shaped recess formed in the stock, A, in which recess it is free to move up and down. In the lower ridge or face of the gun stock is fitted an escutcheon plate, through which an external screw passes, the projecting end of the screw terminating in a milled bead, C. This screw fits the internal screw of the flanged tube, and upon turning the milled bead, C, in one direction the plate, B, is caused to rise, so that when taking aim at long distances the marksman raises the check plate to such an extent, that when the gun is placed in taking aim, the plate, B, rests firmly against the side face of the marksman, and the aim is thus taken with much greater comfort as well as precision. In this way, when firing at long ranges, the stock of the gun may be lowered to any required extent without inconvenience, as the head rests steadily against the check plate, B, whilst the eye is directed along the surface of the plate in a line with the sights and barrel. By turning the screw, C, in the opposite direction, the check plate, B, is brought down closely on the stock, in which position it offers no impediment to the ordinary use of the gun. The patentee describes various other mechanical contrivances arranged for raising the check plate; but the modification just described he found to be the most simple, as well as efficient in practice.

Fig. 2.

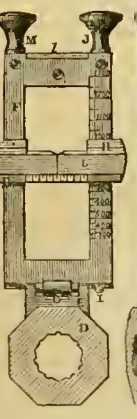
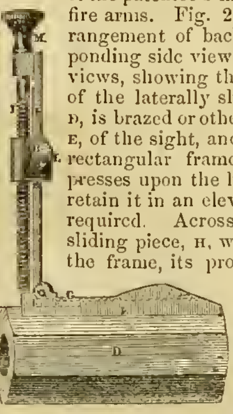


Fig. 3.



Figs. 2, 3, 4, 5, and 6 illustrate several of the patentee's improvements in back sights of fire arms. Fig. 2 is an end elevation of one arrangement of back sight; figure 3 is a corresponding side view; and 4, 5, and 6 are enlarged views, showing the details of the arrangement of the laterally shifting sight. To the barrel, D, is brazed or otherwise attached the base plate, E, of the sight, and to this plate is hinged the rectangular frame, F. A blade spring, G, presses upon the heel of the frame, F, so as to retain it in an elevated or depressed position as required. Across the frame, F, is fitted the sliding piece, H, which traverses up and down the frame, its proper position being regulated according to the numbered graduations on one limb of the frame. The sliding piece, H, has a projecting part formed on the back of it at one side, as shown in figures 3 and 5; this part is screwed internally, and has fitted to it the vertical screw, I. The upper part of this screw is plain, and works through a collar formed on the back of the frame, F, and terminates in a milled head, J. Upon turning the head, J, the slide piece, H, carrying the sight, is raised or lowered, and is by this means set with the greatest nicety to the required position, and without the possibility of its shifting during the loading or firing of the gun. In addition to the vertical traverse of the sight piece, H, it is also arranged to move laterally, so as to allow for the pressure or force of the wind upon the projectile, and so avoid the necessity of making this allowance in taking aim. The parts of this portion of the sight are better shown to an enlarged scale in figures 4 and 5. Figure 4 is a front view of the sight piece, H, with the laterally traversing sight plate, L, removed. Figure 5 is a sectional elevation taken at right angles to figure 4, on the verticle line, 1-1. The vertical sliding sight piece, H, is recessed longitudinally to receive the screwed spindle, K, which is placed loosely in the recess formed for it in the piece, H. The screw of the spindle, K, projects beyond the recessed part, and takes into the internal screw which is formed in the grooved part of the sight plate, L. This plate is bevelled at the edges, and is fitted into a corresponding recess in the part, H. When the parts are put together, the squared ends of the spindle, K, extend into small recesses formed at each end of the part, H, to admit of the insertion of a key for moving the laterally traversing sight plate, L, either to the right or left.

Fig. 4.

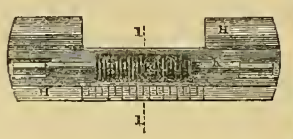


Fig. 5.

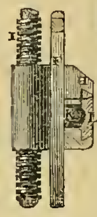
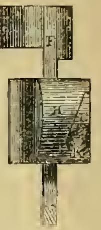


Fig. 6.



The key, M, which is used for the purpose is similar to a watch key, but is made to correspond at the upper part to the head of the screw, I, the spindle of the key is partially screwed externally to admit of its being retained in a small collar formed at the opposite corner of the frame, F. The lower edge of the sight-piece, H, is graduated, as shown in figures 1 and 4, and the transversing plate, L, has a platinum or gold line formed in it at the centre, so that upon turning the spindle, K, with the key, M, the line on the plate, L, which is in a line with the centre of the actual notch or actual sight, may be readily made to coincide with any line on the lower scale. The back of the frame, F, is so graduated that when turned down upon the barrel or inclined planes of the base plate, E, the sliding piece, H, may be used for raising and lowering the sight, I, at the free end of the frame, F, for the comparatively short ranges; that is, by screwing the sliding piece, H, to and fro, by the screw, I, it can be readily and accurately adjusted to suit the required range. Fig. 6 shows an edge view of the upper portion of the frame, F, with the sight-piece, H, in position, of a somewhat different arrangement for shifting the transverse, traversing sight-plate, L. In this modification, the traversing sight-plate, L, is of a wedge-shaped figure when viewed endwise, as seen in figure 6, and the spindle, K, works against the lower face or edge of the plate, L, instead of along the back, as in the first arrangement seen in Fig. 5, but in all other respects the arrangement of the parts is similar to what has been hereinbefore described, the difference of the two sights consisting in the form and arrangement of the traversing plate, L. Another arrangement of back sight is somewhat similar to the foregoing, but has no lateral traverse, and is suitable for use along with an adjustable front sight having a lateral traverse. In this modification, the sight-piece, L, consists of two slips of metal arranged parallel to each other, so as to enclose the frame, F, with the angular, V, sight formed in the centre of the front plate or slip. The slips of metal are connected by screws at each end outside of the frame, F; one of these screws is formed with a projecting, milled head, by turning which the sight-piece, L, may be fixed tightly to the frame, F, at any division on the graduated limb of the frame for the particular range required. This sight is also fitted with the vertical screw, I, for the purpose of raising or depressing the sight-bar, L, though in this case it could be dispensed with.

Fig. 7.

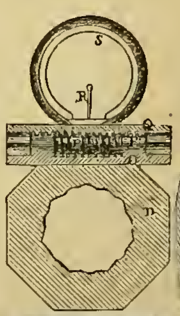
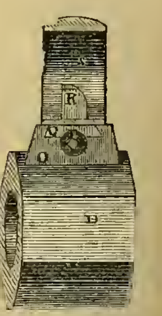


Fig 8.



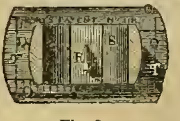


Fig. 9.

The sight-bar, L, in this case, is not provided with any lateral adjustment, such an arrangement not being required where the front sight is constructed with this improvement. The key, similar to M, in Figs. 1 and 2, which is carried at the left-hand corner of the frame, F, is required for adjusting the front sight, some modifications of which the patentee also describes. Fig. 7 is an end elevation, fig. 8 a vertical section, and fig. 9 a transverse sectional plan, corresponding to fig. 7 of one form of adjustable front sight, shown full size. The spindle, P, shown in fig. 7, and in end view in fig. 8, when actuated by the key, moves the traversing plate, Q, to and fro, which carries the sight, R. This sight, which is a small circle at the top of a thin piece of steel plate, is more particularly constructed and arranged for long ranges, and so delicate that it requires a guard, S, to protect it. In the traversing plate, Q, of all the modifications of adjustable front sights there are two lines, T, fig. 9, formed either of gold or platinum, and upon the base plate, O, is a graduated scale, so as to indicate the amount of deviation of the traversing plate, Q. In adjusting this sight, if the wind blows from the right, the sight is moved over to the left hand, and *vice versa.* But in using the adjustable back sight alone, this movement of the sight in a direction contrary to that of the wind is not required, the traversing sight piece, in this case, being moved towards the side from whence the wind is blowing. After a certain amount of practice, the marksman is enabled to adjust the front sight at once to suit the strength of the wind, which would otherwise carry the ball wide of the mark. Another and more simple arrangement of adjustable front sight is described, the base plate, O, of which is dovetailed on, or otherwise attached to the end of the barrel, and has formed in it a channel to receive the screwed spindle, similar to which is made like the spindle hereinbefore described, in reference to K and P in figs. 4 and 7. The screw, P, gives motion to a traversing plate of metal, as Q in fig. 8, which is bevelled to fit a groove of corresponding figure formed in the base plate above the recess for the screw. The traversing metal slip, Q, has fitted to it the sight, R, which may be either fast to the plate or moveable, and is, in this example, of a conical figure, and strongly formed in the usual way, so as not to require a guard. With the key, M, removed from the back sight, the traversing plate, Q, may be moved either to the right or left, the distance being regulated according to the strength of the wind. Another arrangement or modification of front sight is described, in which the sight, R, is of a wedge, or ⍓, shaped figure, when viewed from the end, as in the act of firing. This sight has also a circular guard, as S, in fig. 7, both of which are attached to a sliding piece, which is traversed to and fro together by means of a screwed spindle working in a screw nut, or eye, on its under side, somewhat in the manner of a slide rest. The key, M, as before described, fits on a square on one end of the screw spindle, and by turning it round adjusts the sight to the desired position. The tubular guard, S, which protects the sight from injury, also serves as a sun shade to the front sight, as well as to reflect light upon the sight, and render it quite distinct in the centre of the circular guard in taking aim.

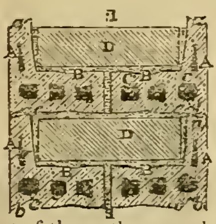
With these several improvements in rifles a degree of accuracy and certainty in striking a given object within a limited area is obtained that with the ordinary arrangements would be impracticable.

WALL FACING.

William Walton, *Charlson, Kent.—Patent dated May* 1, 1861.

Mr Walton's present invention comprehends the arrangement and manufacture of a new and peculiar facing for walls to be used in combination with ordinary bricks, and consists in forming the facing of the wall of blocks, or pieces of terra cotta, or any suitable material made with a flat or even face, which corresponds to the face of the wall, and having a projection at the back, which extends into, and forms part of the wall.

The subjoined engraving represents a transverse vertical section of a portion of a brick wall, showing one mode of applying the new facing blocks for the purpose of forming the improved faces on both surface of a double wall, and that portion on either side of the central dotted line, 1—1, shows the mode of applying them to a single brick wall having one face, both as formed in accordance with this invention.



These improved blocks, or face pieces, may be formed by any of the methods commonly used for working clay and other similar plastic materials, suitable dies or tools being employed for giving the required form to the block, and making the preparations therein.

A is the portion of the block or piece, which is intended to form a portion of the wall facing. B is a projection which is intended to be inserted or built in, and to form part of the wall. C are longitudinal passages, or perforations which are formed in the blocks, or pieces, A B, for the purpose of diminishing the weight, and also for carrying bell or telegraphic wires, or which when required, may be used for the purposes of ventilation The top part, *a*, of the portion, A, of the block or piece, is bevelled or sloped downwards towards the exterior, or face of the wall, and the lower portion, *b*, is bevelled, or inclined upwards towards the interior of the wall, as shown in the accompanying engraving. The angle of the upper part, *a*, with the face of the wall, may be rather more obtuse than the angle of the lower part, *b*, so that when the lower part, *b*, of an upper block or piece rests upon, or is placed above the upper part, *a*, of a lower block or piece, the mortar which unites the two pieces, takes the shape of a wedge, of which the thinnest edge only is exposed to the atmosphere, as will be clearly seen at the central part, where these two surfaces are shown as cemented together, but the patentee does not consider such difference of angle essential to the invention; the object in using such angles being to prevent water lodging on a horizontal surface, and penetrating the wall through the mortar. The under surface of the block should also be so formed that when two blocks are set, the lower corner of the reverse incline, *c*, may be about on a level with the highest point of the incline, *a*, of the lower block. The blocks, or pieces, A B, may be of any required size, but for ordinary purposes it is preferred to make them about 14 inches in length, the portion, A, being about 6 inches in depth, and the portion, B, about 6 inches wide, including the thickness of the facing, A, which is about 2½ inches. The part, A, may also slightly increase in thickness towards its lower end, as shown in the engraving, where it meets and unites with the projection portion, B.

In making the wall facing care should be taken to use only the best mortar between the two bevelled edges, *a* and *b*, but common mortar may be used for the purpose of uniting the bricks with the wall facing, or in some cases the space between, *a* and *b*, may, if preferred, be left entirely without mortar or cement.

In building a single faced wall according to this invention, the blocks, or pieces, A B, and ordinary bricks, D, are placed in alternate layers, and made to break joint, as shown on one side of the dotted line, 1—1; and when it is wished to form a facing on the interior surface of a wall, as well so as to dispense entirely with internal plastering, and form double faced wall as shown by the entire engraving, the blocks, or pieces, are placed so that the projections, B, meet each other, and the bricks, D, are laid upon such projections in the manner there shown.

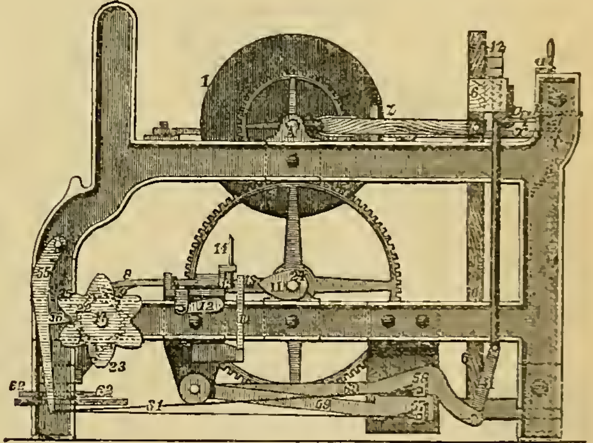
LOOMS.

J. H. Johnson, (S. T. Thomas, *Laconia, U S.)—Patent dated April* 6, 1861.

This invention has reference firstly to the general arrangement and combination of the parts of looms for weaving figured fabrics, and consists, ***firstly***, of a peculiar combination of mechanism for working the harness; *secondly*, of a peculiar combination of mechanism for instantly stopping the loom when requisite; *thirdly*, of a peculiar combination of mechanism, with a Jacquard for working the drop or shuttle-boxes of looms; and, *fourthly*, of a peculiar arrangement of Jacquard, and of the "cards" employed in machines of that kind.

Fig. 1 of the accompanying engravings is a side elevation of one modification of loom, embodying several of the improvements communicated to the patentee. Fig. 2 is a plan corresponding to fig. 1. Fig. 3 is a

Fig. 1.



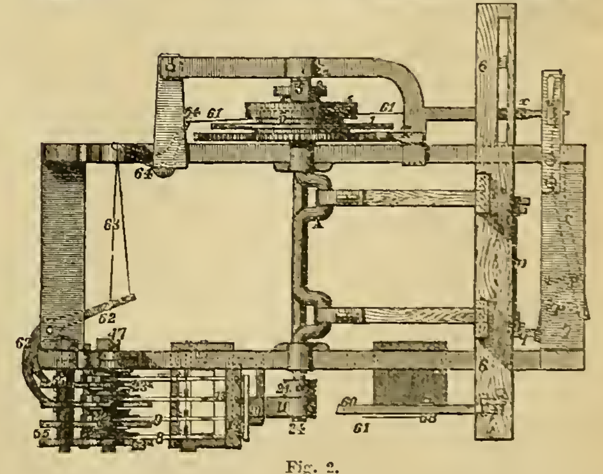
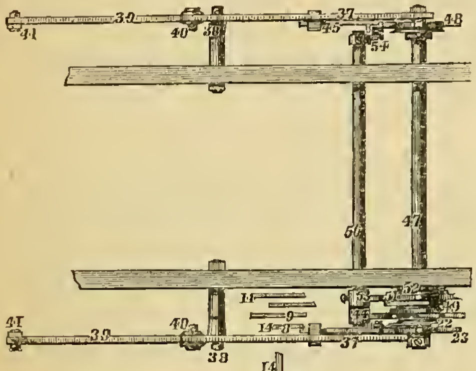


Fig. 2.

plan of the same, showing more particularly the mechanism for working the shuttle-box, and fig. 4 is an elevation of the same detached, showing the action of the star and ratchet wheels, fig. 5 being a horizontal section of these star and ratchet wheels, with one end of their shaft corresponding to the same drawn to a larger scale. Figs. 6 and 7 are a back elevation and plan of the mechanism for working the harness and other minor parts, and figs. 8 and 9 are end and side elevations of the Jacquard barrel and movement for working the pattern shuttle-box, showing the construction of the cards, &c.

Under the first head of these improvements is described the harness movements, which are shown more particularly in figs. 6 and 7 of the conjoined engravings. The crank shaft, A, turning on suitable bearings attached to the main frame of the loom, carries at one end a scroll-cam, B, this cam, as well as other parts of the mechanism being represented in tho position they occupy when the barness, C D *c*, is at the centre of its traverse. The scroll cam, B, is adjustable upon the crank shaft, A, by which means the time of the action of the harness is made to correspond with the motion of the lathe. The spiral groove, E, in this cam receives the friction wheel, F, which is attached to tho upper end of the vertical arm of the right angled lever, O. As the cam, B, revolves, the friction wheel, F, follows the groove, and elevates or depresses the free end of the horizontal arm of the lever, G. To this end of tho lever the vertical rod, H, is jointed, its upper end being passed through the guide, J, that is, fastened to the top beam of the loom. The vertical rod, H, is termed the lifting shaft, its office being to lift the horizontal bar, K, at proper intervals, this bar being fixed to the shaft by the set screw, L. The groove, M, in the scroll cam is occupied by the friction wheel, N, which is attached to the upper end of the bent lever, O. To the other horizontal end of this lever the jointed shaft, P, is attached, and passed through the guide, J. This shaft is nearly parallel with the lifting shaft, H. Its office is to depress the horizontal bar, Q, which is fixed to it by the set screw, R, at proper intervals. If it be thought desirable, a double crank may be used instead of the scroll cam, B, to impart motion to the lifting and depressing shafts, H and P, the same being attached to the main shaft of the loom.

Fig. 3.



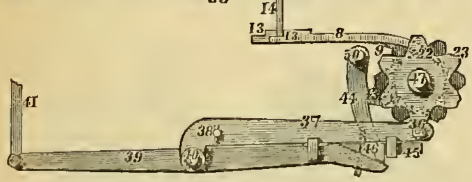
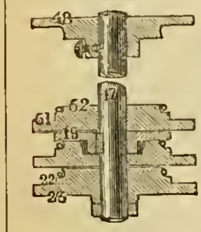


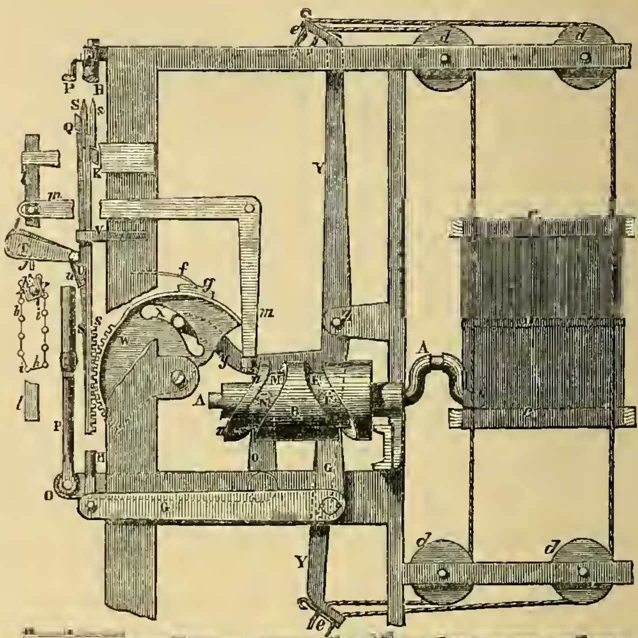
Fig. 4.

Fig. 5.



One of the most important features of these improvements is that all the leaves of harness, and consequently all the warp threads remain stationary or at rest on an open shed (either up or down as the case may be), until they are required on the opposite side of the fabric; that is, they remain at rest floating upon one side of the fabric until the design of the fabric, as indicated by the pattern cards, requires them upon the opposite side. By these means the wear of the warps and harnesses, and also the mechanism connected therewith, is very much diminished. The lathe beats up, or strikes the weft on an open shed, in the same manner as in a tappett loom. The manner in which this is effected is hereinafter described. Each leaf of the harness, C D *c*, requires a corresponding rack or needle, S *s*, to give it motion at the right instant of time. These rack needles have near their upper end two notches, *a* and *b*, upon opposite sides, so formed as to allow of their being lifted by the horizontal bar, K, or depressed by the bar, Q, when required. These bars, K and Q, being fixed to the lifting and depressing shaft, H and P, respectively. The manner of raising and lowering the rack needles, S *s*, having been shown, it is now necessary to describe the direct effect produced by them upon the *series of leaves of harness*, C D *c*, and the consequent regulation of the design or figure of the fabric. The gravitating levers, T U, and *f u*, are so placed that the short arms, U, can bear upon the rack needles near their middle, and act in one direction, whilst in the other direction the needles are acted upon by the spiral springs and pins, V, and it is necessary that the weight of an arm, T, should be about double the force that is exerted by a spiral spring, V, in order to produce the desired effects as stated. It will thus be seen that the position of the needles either to the right or left determines whether the notch, *b*, shall be struck by the lifting bar, K, or the notch, *a*, struck by the depressing bar, Q. If the former takes place, the needle, S, is raised, and the rack at its lower end acting on the toothed sector, W, moves it upwards, the cam groove, or curved slot, X, made through the sector, W, giving motion to a small antifriction pulley attached to the end of the short bent horizontal arm, *y*, of a tri-armed lever, Y *y*, and plays within the curved slot. The lever or harness bar, Y (sometimes called the jack), is nearly vertical in its position, whilst its short arm, *y*, extending to the sector, W, is nearly horizontal. The vertical part, Y, of the lever bar, has its fulcrum at the rocker pin, Z, near its middle. To the upper and lower ends of this vertical harness lever, Y, two cords are attached. Thus the two cords from the upper end of the harness lever, Y, pass over the antifriction guide pulleys, *d*, below which they are fastened to the harness bars, C and *c*, and thence carried round and under another pair of antifriction guide pulleys, *d*, similar to the first (all carried by the main frame of the loom), and thence to the lower end of the harness lever, Y, where they are made fast. These cords work nearly parallel with each other, and are so fastened to the ends of the harness lever, C and *c*, as to keep them parallel with each other. The pins, *e*, at the ends of

Fig. 6.



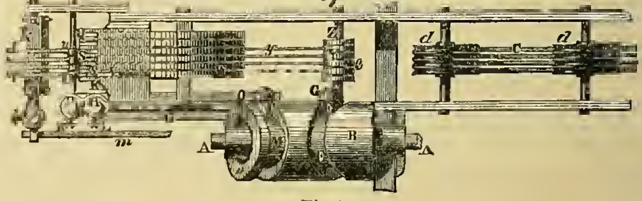


Fig. 7.

Fig. 8.

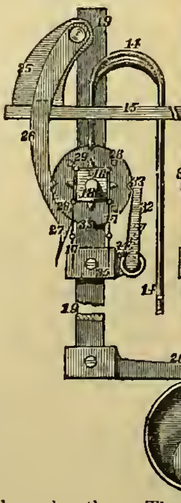
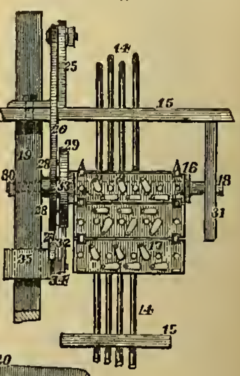


Fig. 9.



the harness lever, Y, serve to regulate the tension of the harness cords, and it will be observed that this mode of attachment of the cords, both at the top and bottom of the rocker or harness lever, Y, will give a very steady and positive motion to the harnesses. All the other leaves of the harness lying parallel with the first one, C D *c*, are moved by their respective rack needles, sectors, harness levers and cords, in the manner above described in reference to it. A friction spring and break, *f*, *g*, is applied to the periphery of the sector, W, to ensure a steady motion. The pattern cards, *h*, which are made of tin, are attached to each other by the rings, *i*, forming the pattern chain, which is suspended upon the *pattern prism* or barrel, *k*, having two pins upon each of its sides near its ends. These pins enter into corresponding holes in the ends of the *tin cards*, *h*, and when a side of the prism, *k*, is horizontal, retain each card, in succession, in the same relative position. As the pattern chain is suspended in a long loop from the prism, its weight assists in keeping the card in close contact with the upper surface of the prism. The pattern prism, *k*, is supported in a frame provided with suitable bearings, in which the axis of the prism turns. This frame receives a vertical motion, once up and once down at each beat of the lathe, which motion is imparted to it by the vertical shaft, *l*, which rises and falls by the action of the bell crank lever, *m*, the lower vertical end of this lever being provided with an antifriction pulley, which plays in contact with the curved end, *n*, of the scroll cam, B, at its edge. The shape of the curve at the end of the scroll cam, B, is such as to elevate and depress the pattern prism, *k*, at the right time to throw the lifting and depressing rack, S *s*, in contact with the horizontal lifting and depressing bars, K and Q, this being effected by means of the holes in the pattern card, and the pin, *j*, attached to the gravitating levers, T *t*. The vertical movement of the prism, as above described, is an important improvement, as by its use the card occupies a position at the top of the prism, and remains in close contact with it, whilst in looms heretofore used the acting or working card is in a vertical position, and mechanism, which requires nice adjustment, is necessary to keep the card up to the vertical working face of the prism. The leaf of harness that it is to be raised or depressed is indicated by the position of the holes in the pattern card, which are a little larger than the pin, *j*, projecting at right angles from the lower side of the gravitating lever, T. When this pin enters a hole in the card, the short-arm, U, moves forward a short distance, and inclines the top of the rack-needle, S, bringing its notch, over the lifting bar, K, and thus establishes a connection with the harness by means of the sector, the harness lever, and its attached harness cords or bands as before described. In all "fancy looms" heretofore constructed, all the warps are closed together at or during every beat of the lathe, and previous to the elevation and depression of such of them as were to be used for the next throw of the shuttle. This mixing of the warps does not take place in this improved loom, for those warps which have been either elevated or depressed are maintained stationary, either up or down, as the case may be, when the lathe beats up, and are never moved until they are wanted to effect a change in the figure of the fabric.

In pattern chains heretofore made, perforated cards have been used, and when the figure or design was to be changed, new cards were required. Now, according to one part of this invention, each hole of the pattern cards, *h*, is provided with a button, *o*, as seen in fig. 9, riveted at one of its ends to the card. By turning the button, the hole is left open or closed at will, so that the same cards, made in this way of tin plate, can thus be used for a great variety of patterns. The changes in the cards may be made, by the use of a suitable key or wrench, whilst the cards remain in their position in the loom, a few minutes only being required for making this change for a new pattern. Fig. 9, just referred to above, relates to the motion of the shuttle-box; but as the cards for this purpose, and for the harness motion, are of the same construction, it was unnecessary to give a separate figure.

The improvement in the shipper and brake for starting and stopping the loom is represented in figs. 1 and 2. The protector rod is seen at *q*, and projecting from one end of it at right angles is the dagger, *q*. If the shuttle fail to reach the box, this dagger comes in contact with one end of the bell crank lever, *r*, fig. 2, and moves it a short distance. The other end of this lever is jointed to the rod, *v*, the motion of which brings an inclined plane near the other end of this bar, in contact with one side of a slot in the loom frame, through which the bar, *v*, passes, thus moving the shipper spring, *w*, out of the notch in its holding plate. This allows the shipper, *x*, and its attached brake, *z*, to move horizontally against the friction disc, 1, and it is there held by the tension of the shipper spring, *w*. This same motion of the shipper, *x*, acting through the clutch and collar, 2 and 3, removes the driving pulley, 4, from contact with the driving cone, 5—the friction is thus applied to the flange, 1, at the same instant that the driving cone is released. The lathe, 6, is thus arrested, and its momentum nearly overcome before the dagger, *q*, reaches the fixed stop, 7, *thus avoiding the sudden concussion* that takes place by the stoppage of a loom with tho apparatus heretofore in use. When the stoppage of a loom is caused by the breaking of the filling or weft thread, the brake, *z*, instantly stops the loom, so that the main crank makes *but about half a revolution*, whilst the shippers commonly used allow the crank to continue in motion, and the shuttle makes several shots before the loom is stopped.

The vertical motion of the shuttle box, by which different shuttles are brought into position as required, is governed by a Jacquard apparatus, as shown in figs. 1, 2, 8 and 9. The palls, 8 and 9, are nearly horizontal, and are placed near the bottom of the loom, the end of each pall bearing against a vertical rocking lever, 10, which is operated by the cam, 11, fixed on the outer end of the tappet shaft, 24, which strikes against its upper end. To each of these palls is also applied a gravitating lever, 12, the rear end of each pall, 8 and 9, being provided with a notch or shoulder, as seen at 13. Each pall is also provided with an upright wire, 14, which is supported so as to slide freely in a vertical direction through guides, 15. The upper ends of these wires are curved in a semicircle, and operate in connection with a pattern prism, 16, and pattern card, *h*, linked in a chain, 17, by the ring, *i*, (as before described in reference to the prism or barrel, *k*, for working the harness), and suspended in a long loop from the prism, as seen in fig. 9 The shaft, 18, of the pattern prism projects horizontally from a slide rod, 19, from which an arm, 20, extends towards and rests upon a cam or eccentric, 21, which is fixed upon the cam shaft, 24, supported in suitable bearings attached to the main frame of the loom. The rotation of this cam, 21, elevates the slide rod, 19, and its attached pattern prism, and it falls when the shape of the cam allows it. Whenever any one of the wires, 14, enters the hole of its pattern chain, 17, the lower end of it will remain below the top of the shoulder, 13, of its pall, 8, and will prevent that pall from being retracted by its gravitating lever, 12, and carried into contact with the rocker lever, 10, during the rotation of the cam, 11, fast on the shaft, 24; but such of the wires as are elevated by the hole being closed by the button, *o*, in the pattern chain, 17, will relieve the lower end from the shoulder, 13, of its pall, 8, and will allow it, by the gravitation of the lever, 12, to be brought into contact with the rocker lever, 10, which turns the ratchet wheel, 22, by the action of the cam, 11, so as to rotate their respective star wheels, 23, the order or interval of such rotation being governed by the pattern prism, 16, and its chain, 17, the details of which will now be described. A standard, 25, is attached to a part of the loom frame, 15, and has at its upper end a fixed pin, from which hangs the operating pall, 26, and the hook, 27, is in position to engage with the four pins, 28, in succession, which are affixed to the prism head, 29. The prism slide rod, 19, which moves vertically, as hereinbefore described, carries the prism shaft, 18, which is held fast to it by the nut, 30, and as the prism rises and falls the opposite end of the shaft, 18, traverses in a slot in the fixed arm, 31, which is attached to the frame, 15, of the loom. As the prism falls, the hook, 27, of the pall, 26, engages with the pin, 28, and the prism is turned one quarter round, bringing the next pin, 28, into the position previously occupied by the former pin, and thus bringing the next pattern card of the chain to its working position at the top of the prism, in which position the prism is retained by the catch pall, 32, which enters one of the four notches, 33, made in the prism head, 29, and is held up by the action of the spring, 34, the lower end of this pall, 32, being attached to the prism slide rod, 19, by the collar, 35. This quarter of a revolution takes place at every downward movement of the prism slide rod, 19.

The next part of this motion to be explained is the action of the star cams upon the series of shuttle boxes, which are moved vertically for the purpose of changing the colour of the filling or weft thread. (See figs. 1, 2, 3, 4, and 5.) When the palls, 8 and 9, move their ratchets, 22, one tooth, the projecting points of the star cams, 23, come in contact with the roll, 36, at the end of the suspension lever, 37, which has its fulcrum at 38, and depresses it, giving a corresponding elevation to the further end of the lever, 39, which is suspended near its middle by a rocker pin, 40, passing through the descending curved end of the lever, 37. At the farther end of the lever, 39, the rod, 41, is attached through a long connecting rod at its upper end to the series of shuttle boxes, 42, (as see more particularly in fig. 1,) which rise and fall by the action of the star wheels as described. The star wheel, 23, (fig 4.) acts upon the short arm, 43, projecting from the lever, 44, the lower end of which carries forward the slide, 45, and its attached projecting wedge, 46, which, as it moves forward, traverses upon the inclined plane at the end of the suspended lever, 39, and depresses it, causing it to turn upon the pin, 40, thus elevating its further end, which gives a vertical motion to the shuttle box rod, 41.

It will be observed that the motion of these two levers, 37 and 39, is of two kinds. In the one first described the two move together, and carry the shuttle box, 42, up or down one space or compartment of the box. In the second described (the wedge, 46, being moved forward) the distance traversed by the shuttle box rod, 41, and its attached box, 42, is doubled, this effect being produced by the simultaneous thrust and conjoined action of the wedge, 46, and the star cam, 23.

To operate the shuttle box upon the opposite side of the loom, the shaft, 47, extends across, revolving in suitable bearings, and has a star wheel, 48, attached upon that side which is turned by the ratchet, 49, fixed to the said shaft, 47, by the key seen in fig. 5, the relative position and motion of the levers, 37 and 39, on the other side of the loom, worked by the star wheel, 48, and also of the slide, 45, and wedge, 46, being similar to those indicated by the same numbers upon the opposite side already described in reference to the star wheels, 23. The shaft, 50, also extends across the loom, and is operated upon by its star wheel, 51, and its ratchet, 52, by means of the arm or lever, 53, which is fixed to the nearest end of the rocker shaft, 50; to the other end is attached the collar and arm, 54, and at its lower end carries an antifriction roller, the same as that which moves the slide, 45, and its attached wedge, 46, already described, is similar in its position and action to those in reference to the opposite side. Each star cam and ratchet has a groove or pulley formed in it to receive a friction card, or wire, which gives them steadiness and uniformity of motion. The mechanism, as shown in the engravings, is sufficient to operate six shuttle boxes, three upon each side of the loom, which is equal to the use of five shuttles, or five colours of weft; and any one of the six boxes that is required may be brought to the level of the race board, at any one pick or stroke of the lathe, and may be retained in the same position during any successive number of picks that the design or figure of the fabric may require. The patentee does not confine himself to any particular number of shuttle boxes, as more or less may be used than here described by adding to the series of cams, palls, levers and slides, moving and operating together, as hereinbefore described.

Instead of communicating a vertical motion to the shuttle box, 42, by means of the combined lever, 37 and 39, as shown in figs. 3 and 4, it may be effected as represented in figs. 1 and 2. The cam, 11, attached to the cam shaft, 24, carrying the cam, 21, acts upon the rocker lever, 10, which moves the horizontal palls, 8 and 9, according to the position of the wire, 14, leading to the shuttle box Jacquard as before described, and turns the first ratchet wheel, 22, and its attached star cam, 23, at proper intervals. The series of suspended bent levers, 55, 56, &c., which are acted upon by their respective star cams, ratchets and palls. The levers are suspended from a fixed pin, projecting from the side frame of the loom, and have on one of their sides a projection or short arm, 56. At the lower ends of the two first of these levers, 55, the wires, 61, are attached, and extend nearly parallel with each other, to the wedges, 57 and 58, the lower wedge, 57, traversing at its lower edge upon a fixed slide or guide, while its upper edge runs in contact with an inclined plane formed upon the lower side, and near the end of a rocker lever, 59. The other wedge, 58, traverses on a slide at the top of the lever, 59, and its upper edge runs against the lower side of the rocker lever, 60. The free end of this lever, 60, extends beyond the wedge, and is jointed to the connecting rod, 41, which is attached to the shuttle box, 42, through its lifting rod. The two suspended levers, 55, at the back or nearest the frame, are connected with the bent levers, 62, which pull the wires, 63, respectively connected with the bell crank levers, 64, giving motion through rods or wires, 61, to slides and wedges corresponding to the slides and wedges, 57 and 58, and moving the shuttle boxes upon the opposite side of the loom at proper intervals.

BOOTS AND SHOES.

Charles Roberts, *Douglas, Isle of Man.—Patent dated April* 13, 1861.

This invention relates to a peculiar construction of boots and shoes, and other similar coverings for the feet, whereby they are rendered more durable than when constructed in the ordinary manner.

According to this invention it is proposed to substitute for the ordinary leather welt, one composed of metal. This metal welt may be made of copper, brass, or other suitable metal, or alloy, and is so shaped as to fit neatly round the edges of the sole or heel, the portion enclosed between the inner and outer sole being perforated or notched so that the leather may become imbedded therein, and so retain the welt in its place, or, if desired, the fastenings for the sole may be inserted into the metal welt, perforations being made therein for that purpose.

Fig. 1 of the accompanying engravings is a side elevation of the lower part of a boot constructed according to this invention with a metal welt along the side and round the heel. Fig. 2 is a transverse section through the broadest portion of the sole of the same boot, but to a somewhat larger scale than fig. 1; fig. 3 is a similar transverse section taken through the heel, and fig. 4 is a perspective view of a portion of the metal welt for the point of the sole looking on the under side detached. A is the ordinary outer sole of the boot or shoe, B the heel; and *a* the inner sole. The metal welt, C and D, are so shaped as to fit accurately the contour of the heel and sole respectively, and are strengthened by being made of an angular section somewhat similar to angle iron, the flange, *e*, being perforated as shown in fig. 4, to receive the fastenings of the heel or sole, and is introduced between the inner and outer soles, as shown in figs. 2 and 3, whilst the flange, *d*, is made to fit against the outer edge of the heel, and downwards to that of the sole, as shown in figs. 2 and 3; its depth being regulated by the thickness of the sole and height of the heel. The middle portion, E, or waist of the sole is not provided with a metal welt, such welts being intended more particularly for the tread portion of the sole.

Fig. 1.

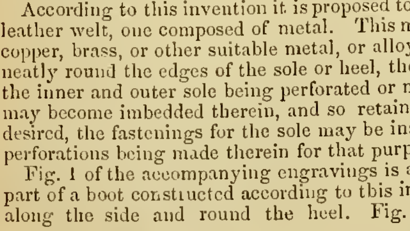


Fig. 2.

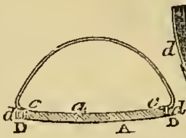


Fig. 3.

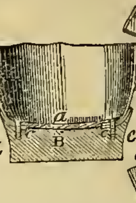
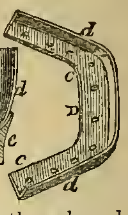


Fig. 4.



PRINTING TEXTILE FABRICS.

H. J. Davies, *Carlisle.—Patent dated May* 11, 1861.

This invention relates to the arrangement and construction of machinery apparatus or means for facilitating the process of printing textile fabrics or materials. The machinery or apparatus is adapted for printing two or other number of colours at one operation upon the fabric or material.

Fig. 1 of the accompanying engravings is a perspective view of one modification of the improved machinery or apparatus arranged according to this invention, so that several colours may be simultaneously transferred to, and printed on, textile fabrics or materials, and fig. 2 is a plan of the colour box. Figs. 3 and 4 are a section and plan of the under side of the "lifter" respectively for transferring the colours from the "map," G, to the raised surface, N, of the sieve, M. The colour box or receptacle, shown in plan, fig. 2, with cover or map, G, removed, is arranged at one end of the apparatus. It consists of a box made of glass, earthenware, or other suitable material, which is protected externally by the wooden casing, A. This colour box is made higher at one end than the other part, and in this part are formed a number of cells, B, arranged parallel to each other, and communicating with longitudinal channels, c, formed at the bottom of the colour box, and indicated in dotted lines in fig. 2. In the example shown in the accompanying engravings, there are four colour cells, B, shown, but the number may be varied according to the number of colours required to be printed. The channels, c, form a series of longitudinal chambers, the bottoms of which are made concave, and slope downwards in the direction of the spouts, D, the egress of the colours being prevented by sliding doors or other equivalent means. Above the channels, c, is formed a series of transverse cells, E, the lower parts of which are formed of a concave figure, as shown in fig. 2. An aperture, F, is made through the bottom of each cell, E, so as to communicate with one of the channels, c. The positions of these apertures are so arranged that the several cells are made to open into the colour channels, c, in a predetermined order or sequence. In the arrangement delineated in these figures, there are sixteen transverse cells, E, each series of four being in communication with one of the channels, c. It follows from

Fig. 1.

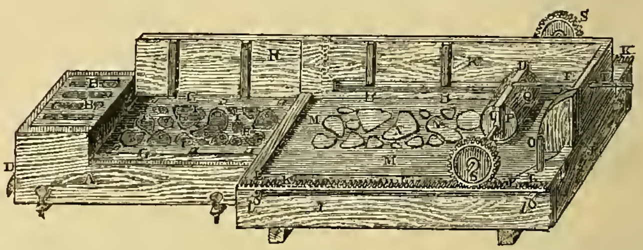


Fig. 2

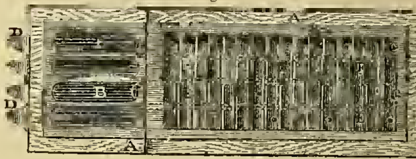
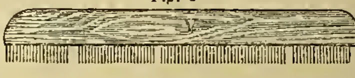


Fig. 3



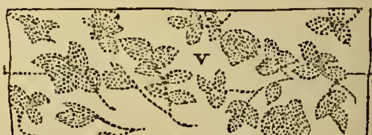


Fig. 4.

MINERAL TANK L

BY MESSRS. FLETCHER

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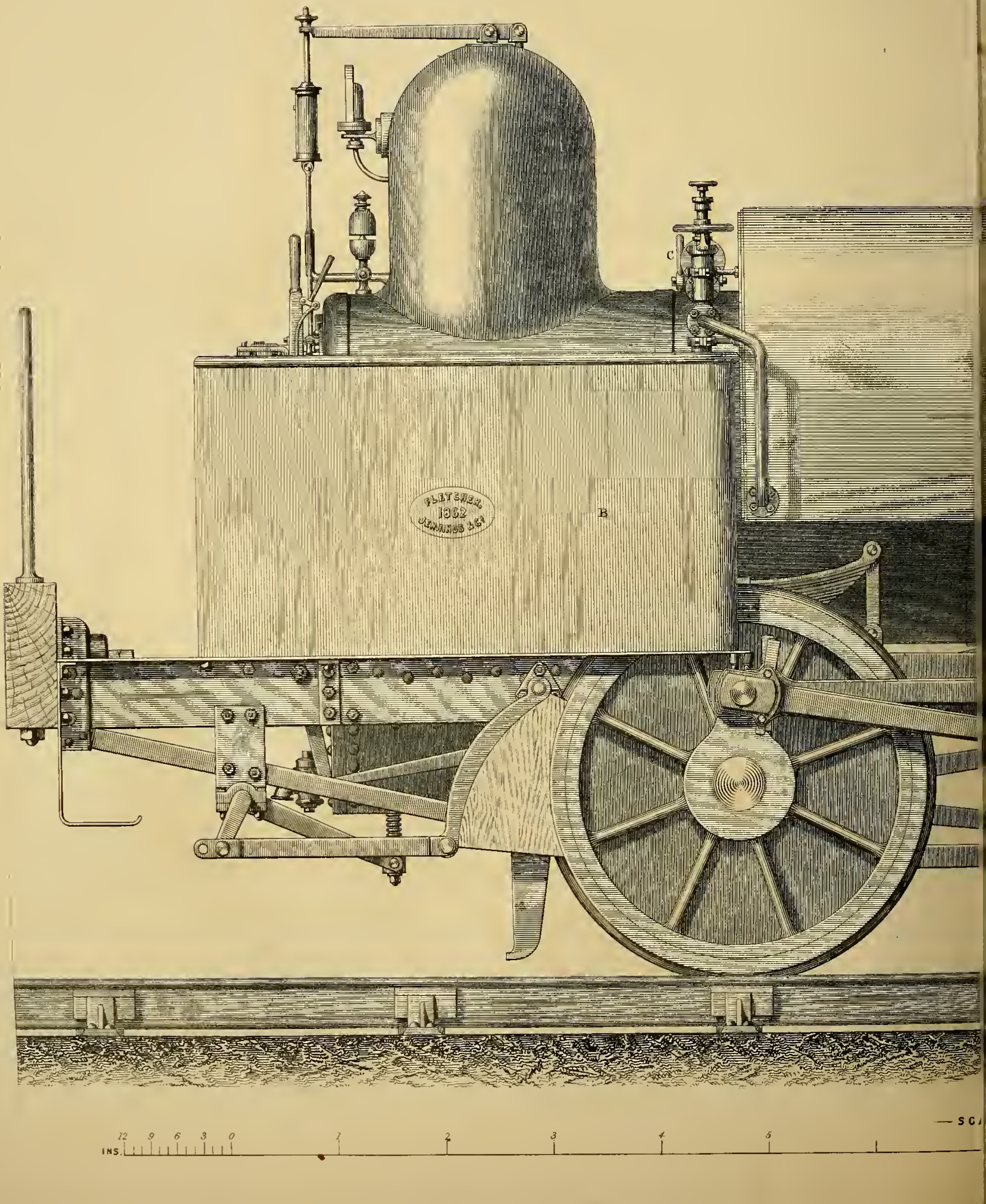

OMOTIVE ENGINE,

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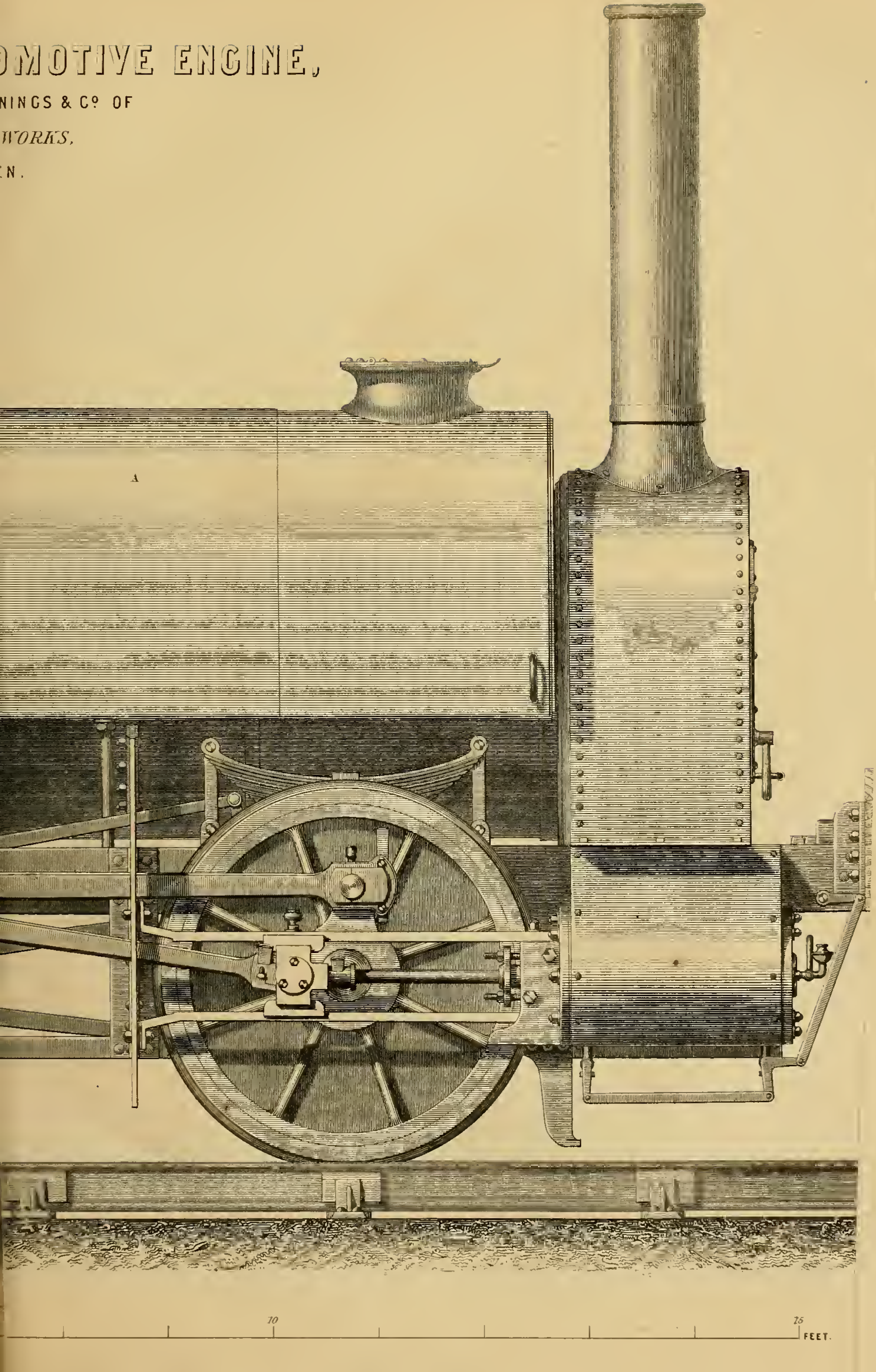
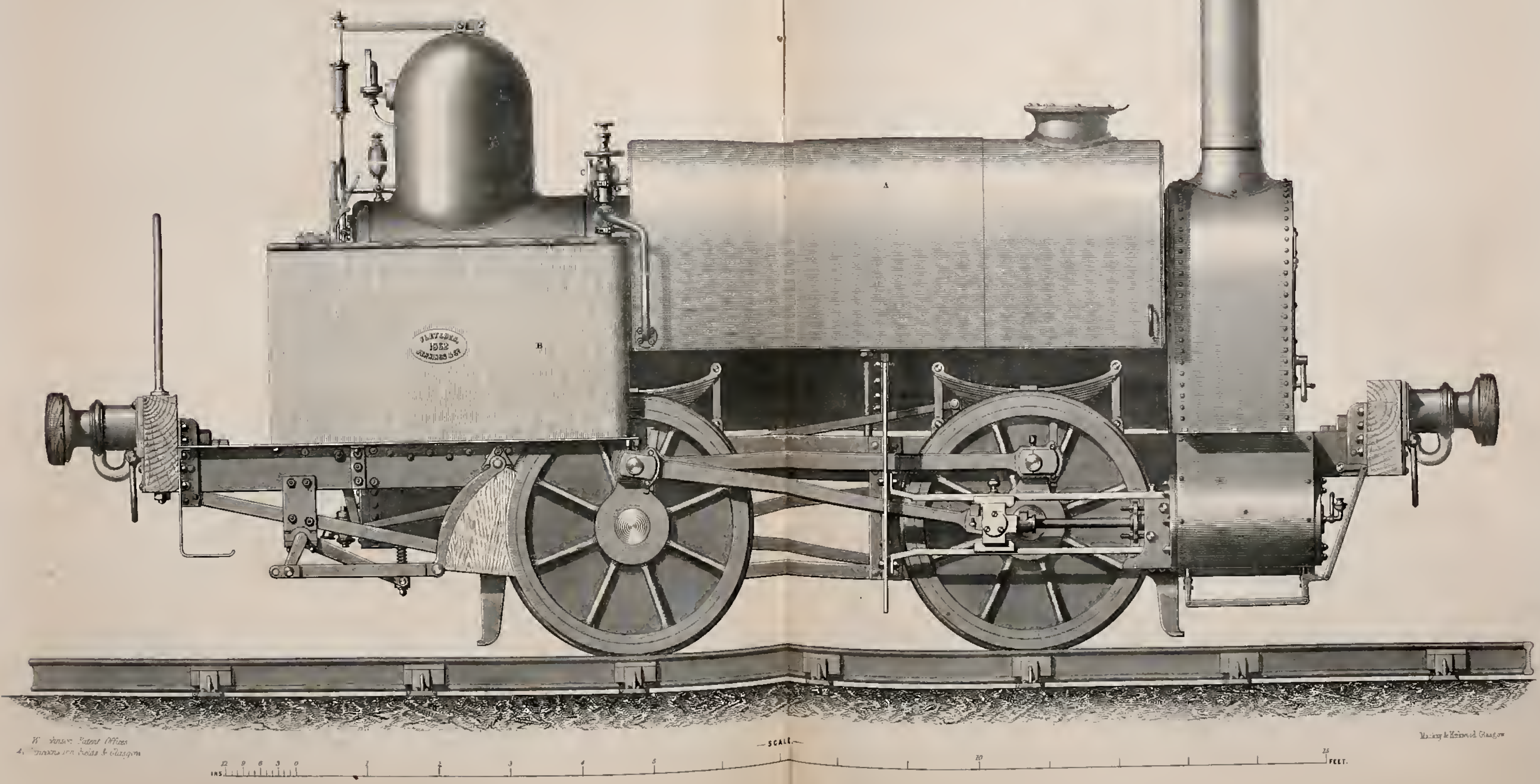


MINERAL TANK LOCOMOTIVE ENGINE,

BY MESSRS FLETCHER, JENNINGS & Co OF
LOWCA ENGINE WORKS,
WHITEHAVEN.



W. Johnson's Patent Offices
47 Lincolns Inn Fields & Glasgow

Mackay & Kirkwood Glasgow

this that when the colours are poured into the cells, D, each colour flows into its separate channel, C, and up through the apertures, F, into the cells, E. Upon the cells, E, is placed a "map," G, which is bolted down to the box, A, and made colour tight by means of india rubber or other suitable material being put between the map and the colour box, and as shown in the perspective view, fig. 1; this map is formed of a block of wood, metal, earthenware, or other suitable material. It has formed in its surface a series of sunk or recessed figures, H, each of which is devoted to a distinct colour. These recessed parts communicate by means of tubular apertures, I, with the colour cells, E, beneath, so that when the map is fitted into its place the colours flow up into the figures, H. The colours are maintained at a uniform height, and prevented from overflowing the map, G, by means of bottles filled with colour, and immersed with their necks downwards in the colour cells, D, so as to regulate and keep the colours at the required height in the several compartments of the map. Adjoining the colour box, A, is arranged a "swimming tub," which consists of a rectangular wooden vessel, J, having a longitudinal rack, K, fitted at each side of it. These racks are carried in laterally projecting brackets, L, in which are fitted thumb screws, *l*, by which means the racks may be adjusted up or down with great accuracy. On the upper part of the swimming tub, J, is fitted the sieve, M. This sieve is formed of a rectangular frame of wood, on the lower side of which is stretched a piece of textile fabric or other material, upon which is arranged a series of figures, N, corresponding to the figures of the "map," G. The figures, N, are formed in relief on the sieve, as shown in fig. 1, and they may be formed of one or more layers of thick woollen or other suitable material. The swimming tub, J, below the sieve, M, is filled by means of the tube, O, with mucilage or other suitable fluid, so as to form an elastic or yielding substratum below the figures, N, on the sieve, M. A portion of the several colouring matters is transferred by means of a lifter corresponding in its general configuration to the pattern that is to be printed. The colours taken up by the lifter are transferred to the raised surface, N, of the sieve, M, upon which they are laid smoothly, and the excess of colour is taken off by means of a roller, P. This roller is made of wood or other suitable material. It is either raised or smooth on the surface as the pattern may require. These figures, Q, if raised, may be formed of metal, gutta percha, or other suitable material. The roller, P, is mounted upon a shaft, one end of which extends through a slot formed in the guard or fence, R, and at each extremity of the shaft is keyed a spur wheel, S, which traverse to and fro on the racks, K. The roller, P, is moved to and fro either by hand or motive power communicating motion to the shaft, T, attached to the saddle piece, U, or in any other convenient manner. By moving the roller over the surface, N, of the sieve, M, the colours are evenly distributed thereon, and the pressure of the roller is accurately adjusted by shifting the racks, K, up or down by means of the screws, *l*, so as to obtain an even film or layer of colour on the raised surface, N, of the sieve, M. From the map, G, the colours are transferred by means of the lifter, a transverse section of which is shown in fig. 3, taken on the line, 1—1, fig. 4, which is a plan of the lower side of the face of the block, showing the teeth of the lifter, V, which are arranged in accordance with the design to be printed on the fabric, so that when the lifter is pressed on the map, G, a certain quantity of colour is taken up from each compartment of the map. The lifter so charged with colour is then pressed down upon the raised surface, N, of the sieve, M, and after the roller, P, has spread the colours evenly thereon, the block is dipped upon it by the printer, and thence upon the fabric or material to be printed, and which is stretched over a table covered with a blanket arranged in convenient proximity to the apparatus hereinbefore described. In this way the printing of fabrics by means of this apparatus, adapted for imparting several colours simultaneously to the printing block, may be carried on with great rapidity, accuracy, and economy.

MINERAL TANK LOCOMOTIVE ENGINE.

By Messrs **Fletcher, Jenning & Co.**, *Locomotive Engine Works, Whitehaven.*

Illustrated by Plate 282.

These little engines have been specially designed for mines, coal, iron, and other works, and for the use of contractors. They are also adapted for shunting, ballasting, and forming roads at the different termini sidings of our public railways for their larger brethren to take away, and are an excellent example of a class of engine coming every day more and more into use.

Tank locomotives, or those which carry their own supply of fuel and water, have, from their great compactness and convenience, come greatly into favour during the last four years; and as they run equally well either end foremost, no turn-tables are required, and the additional weight on the wheels enables them to start heavy loads, and to ascend steep inclines with great facility and with less inclination to stop or surge in what drivers call "greasy" weather.

In the example before us, the general arrangements of the engine is clearly set forth in our illustrative plate, No. 282, which is a complete side elevation of the engine, so that any detailed description would be superfluous. The reader may observe that the water is carried in a saddle-shaped tank, A, resting on the barrel of the boiler, which is a form possessing many advantages both over side tanks and those placed between the frames, being easy of access either to fill, clean, or repair, and does not interfere with the working portions like the former, nor is the capacity limited as in the latter case. Coke boxes, B, are formed on each side of the fire-box, care being taken to place them as far forward as convenient so as not to increase the overhanging weight unnecessarily. The boiler, which is fed by means of a Giffards' Patent Injector, C, attached to the front of the tank, is made rather long in order to allow of the wheels being placed sufficiently far apart, and the whole is so nicely balanced as to work with perfect steadiness—a rare qualification in four-wheeled engines.

From the simplicity and usefulness of the design, and the fact that these engines are fitted and furnished with the same care that is bestowed on main-line locomotives, we have no hesitation in recommending them to favourable notice.

LAW REPORTS.

Trade Marks: Wrappers—Injunction: Kay *v.* Metcalfe.—This was a motion in the Vice-Chancellor's Court, before Sir R. T. Kindersley, for an injunction to restrain the defendant from selling pills called "Kaye's Worsdell's vegetable restorative pills," and "from selling pills in boxes, covers, or wrappers bearing any resemblance to those of the plaintiff." An injunction was obtained against the defendant in 1857, a breach committed, the defendant imprisoned for a year, released, an alleged breach again committed, and a motion made to commit for such breach refused upon a technical ground. The bill had been amended, and boxes were produced on the present motion showing, it was contended, a close imitation of the plaintiff's boxes, &c.

For the defendant it was argued that there was no such imitation as to deceive a purchaser.

His Honour granted the injunction.

Magenta Dye: Leave to Inspect Process.—Simpson *v.* Wilson.—This was a motion in the Court of Queen's Bench before Lord Chief Justice Cockburn and Justices Wightman and Blackburn, for a rule calling upon the defendant to show cause why he should not permit the plaintiff and his witnesses to inspect his works, and the mode in which he manufactured his Magenta dye, and why the plaintiff should not take specimens of the dye, so manufactured by him. The application was made under the 42d section of the Patent Law Amendment Act (the 15th and 16th Victoria, cap. 83). The plaintiff was the assignee of a patent granted to a person named Medlock, for improvements in the manufacture of red and purple dyes; and he had brought an action, against the defendant for an infringement of that patent, in which action issue had been joined, and notice of trial given. One of the component parts of Medlock's dye was dry arsenic acid, and, as specimens of the defendant's dye had been proved, on analysis, to contain arsenic acid, there was some reason to believe that the defendant was infringing Medlock's patent. The plaintiff, therefore, wished to have leave to inspect the defendant's process, and to take specimens.

Counsel stated for the plaintiff that the case referred to was that of the "Type Founding Company *v.* Lloyd" (5 H, and N., 192).

Lord Chief Justice Cockburn said the learned counsel had better take a rule.—Rule *nisi* granted.

Sewing Machines: Howe *v.* M'Kernan: Breach of Injunction.—This was a motion in the Rolls' Court, before the Master of the Rolls, to commit the defendant for breach of injunction. On the first day of the present term the plaintiff obtained an injunction to restrain the defendant from holding himself out as the agent for the sale of Howe's sewing machines, machines other than those manufactured by the plaintiff's company. The plaintiff now alleged that the defendant had not removed from his window in Holborn the words representing that he was the agent for the sale of the machines until upwards of a week after the date of the injunction, and that he had since issued advertisements which concluded as follows:—"Howe's sewing machines always on hand at reduced prices," whereas the fact was, that the defendant had none of Howe's machines, or only a small number, which he had purchased indirectly.

The Master of the Rolls said that, although the delay in complying with the injunction might be a case for damages, it was not a case of committing the defendant as for breach of injunction. With respect to the matter complained of in the advertisement, it appeared to him not to come within the terms of the injunction, but it might form a separate and independent ground for injunction against the defendant, if it was the fact that the defendant had not always on hand some of Howe's machines. The delay of the defendant in complying with the injunction might form ground for refusing the defendant his costs.

After hearing, the MASTER of the ROLLS said that, under the circumstances, it was not a case for costs, as the defendant had obtained the benefit of his own delay in complying with the injunction. He should, therefore, make no order on the motion.

INVALIDITY OF A PATENT PLEADED AS A BAR TO THE PAYMENT OF ROYALTIES UNDER A LICENSE: NOTON *ét al v.* BROOKS.—This was a demurrer in the Court of Exchequer, before the Lord Chief Baron and Barons Bramwell, Channell, and Wilde, to two pleas, denying the validity of a patent. The plaintiffs had granted a license to the defendant to use their invention upon certain terms, on payment of certain royalties. The defendant pleaded that, as the patent was invalid, he had had no consideration, and that the patentees had falsely stated that they were the true and first inventors.

In support of the demurrer, it was contended that the plea was bad, inasmuch as the defendant had, in fact, used the invention.

Counsel argued against the demurrer, relying on "Hayne *v.* Maltby" (3 *Term Reports*), contending that, as the defendant was not entitled by his agreement of license, he was entitled to plead the pleas.

The COURT held that the demurrer was good.—Judgment for the plaintiffs.

FLOATING DOCK: MACLEAN *v.* KENNY—INJUNCTION.—In this case, the plaintiff in person moved for an injunction to restrain the defendant from infringing his patent in the construction of a floating dock, and the Court took the affidavits to read.

The COURT now granted the plaintiff a rule *nisi*.

REGISTERED DESIGNS.

"THE UNITED SERVICE TRAVELLING CASE."

By Messrs MECHI & BAZIN, 112 *Regent Street and* 4 *Leadenhall Street.*

THE purpose of utility to which the shape or configuration of this design has reference, is the obtainment of a compendious, and, at the same time, portable travelling case, serving both as a writing-case and despatch-box, and as a dressing-case or lady's work-box, according to the fittings introduced therein. Fig. 1 represents a perspective view of the "United Service Travelling Case," showing all the compartments opened out, and fig. 2 is a view showing the case closed. This case consists of three principal parts, namely, the base, A, and the two sides, B and C, which are respectively hinged at *b* and *c* to the base. The base, A, contains a drawer, D, which may either be fitted up as a lady's or gentleman's dressing-case, or as a lady's work-box if preferred, without varying the shape of the design. The base, A, is also provided with compartments for the reception of a pen tray with ink holder, and a match-holder. The lid, E, of the compartment, B, forms a writing-desk or slope, and beneath it is a receptacle for despatches or other documents. The compartment, C, serves to contain a blotting pad, and note paper and envelopes, various sizes. It is closed by the flap, H, hinged thereto at *h*, the interior of the flap being fitted with loops for holding any small article likely to be required when travelling. The whole is made to close in the form shown at fig. 2, and is secured by a lock at F, and provided with a handle, which closes down into a recess made to receive it when not required for use.

Fig. 1.

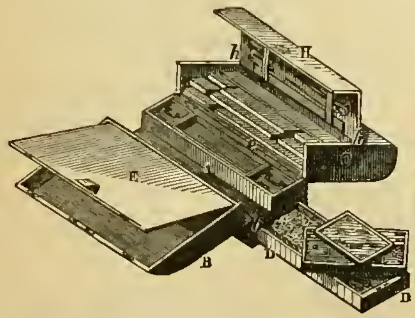
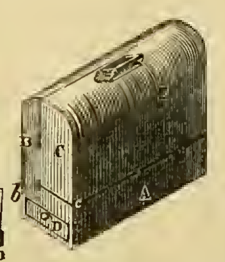


Fig. 2.



REVIEWS OF NEW BOOKS.

SOME ACCOUNT OF THE BUILDINGS DESIGNED BY FRANCIS FOWKE, CAPT. R.E., FOR THE INTERNATIONAL EXHIBITION OF 1862, AND FUTURE DECENNIAL EXHIBITIONS OF THE WORKS OF ART AND INDUSTRY. Large 8vo. Wood Engravings and Lithographs. Pp. 35. London: 1861.

As the time for the consummation of the Great Exhibition project for 1862 draws near, the interest of the public in this greatest of undertakings is gradually converging to the point of enthusiasm. Those who have at all hung back in the matter have begun to see that there is more in it than they would at one time allow themselves to fancy; whilst those who were originally eager for a competitive fray, under such auspices now before them, have redoubled their energy in preparing their samples of manufactures, and in bringing forward their completed or suggestive inventions, as well to afford a fair show of what our island is doing in its industrial phase, as to form land marks of productive and convertive progress for the use of future times. Under these circumstances, Captain Fowke, the designer of the magnificent permanent structure now nearly approaching completion, in which the world's products are to be gathered, has rendered eminent public service in furtherance of the great scheme, by giving us in detail an account of what he has been about in his endeavours to provide the necessary exhibition accommodation.

The site of the principal portion of the buildings adjoins the Royal Horticultural Gardens at South Kensington, lying between Prince Albert's Road on the west, Exhibition Road on the east, and Cromwell Road on the south. The ground belongs to the Commissioners for the Exhibition of 1851, having been purchased by them out of the surplus funds of that exhibition, and the tenure is legally vested in them, although the public are really the proprietors. The Society of Arts is an especial proprietor, and the commissioners have engaged to assign to the Society, on a lease for 99 years, a centre portion of the principal frontage in Cromwell Road. The buildings provide on a large scale for four objects:—1. Picture Galleries, which require to be solid structures, secure from all accidents of weather, extremely well ventilated, and lighted at top; 2. Ample spaces of different forms, and lighted in different ways, for the Exhibition of Works of Industry, arranged in courts and galleries; 3. Platforms and wide passages for ceremonials and processions; and, 4, Accommodation for refreshments.

The picture galleries occupy three sides of a quadrangle. The largest gallery is in Cromwell Road: this is 1150 feet long, 50 feet wide, and 50 feet high above the ground-floor; being about as long as the gallery of the Louvre at Paris. The passage from end to end of this great picture gallery is uninterrupted, although the entrance is in the centre of it. The construction is of substantial brick-work. The piers at the entrance are 14 feet wide, and 7 feet thick; and the foundations throughout are of concrete, 5 feet thick. The walls will be lined with wood, and pictures may be hung if desired to a height of 30 feet. The lighting will be on the principles so successfully demonstrated in the Sheepshanks Gallery, which was the first public gallery perfectly lighted by day and gas light. The entrance to the principal picture gallery in Cromwell Road will be through three noble recessed arcades. They are each 20 feet wide, and 50 feet high, and will look as imposing in their quantities as the principle façade of St John Lateran at Rome, and other Renaissance porticoes in Italy. The visitor enters a vestibule and hall, 150 feet long, and together 110 feet wide, which leads to the industrial halls and galleries; whilst two flights of steps, 20 feet wide, lead on either side up to the picture galleries. These entrances invite elaborate decoration hereafter. The auxiliary picture galleries are in Prince Albert's and Exhibition Roads. They are 25 feet wide, and about 30 feet high, and jointly 1200 feet long, and are, of course, lighted and ventilated on the same principles as already described. They will receive the smaller-sized oil paintings, the water-colour paintings, architectural drawings, designs, and engravings.

The industrial buildings are constructed chiefly of iron, timber, and glass. They consist of the following parts: two duodecagonal domes, which are 160 feet in diameter and 250 feet high, and are the largest of ancient and modern times. The dome of the Pantheon is 142 feet in diameter and 70 feet high; the dome in the Baths of Caracalla was 111 feet; Brunelleschi's, at Florence, is 139 feet in diameter and 133 feet high; the dome of St Peter's is 158 feet in diameter and 263 feet high from the external plinth; the dome of St Paul's Cathedral is 112 feet in diameter and 215 feet high. The domes will be of glass, with an outer and inner gallery. It has been proposed to erect one of Messrs Chance's dioptric lights at the top of one of them, and to illuminate it at night. The vista, from dome to dome, through the nave, is 1070 feet. Each of the domes springs from the intersections of the nave with the two transepts. The nave and transepts are 100 feet high and 85 feet wide; the nave is 800 feet long, and the transepts are each about 635 feet long, including the domes. At 25 feet from the ground a gallery runs at each side of the nave and transepts. There is more than a mile and a half of upper galleries, some 50 feet and some 25 feet wide; two courts, each 250 feet by 86 feet; two courts, each 250 feet by 200 feet; two central courts—that at the north 150 feet by 86, that at the south 150 feet by 150 feet. All these glass courts are 50 feet high, and lighted from above. The refreshment halls are 300 feet long and 75 feet wide; the two arcades have about 1500 feet in length and 25 feet in width.

The machinery galleries are the only portions which are obviously of a temporary character. They extend along the west side of the Royal Horticultural Gardens for about 1000 feet in length by 200 feet wide, in four spans of 50 feet wide each. The iron castings have been executed at the Stavely Iron-Works, Derbyshire. There are 166 round columns for the nave and transepts, 12 inches in diameter, connected with a like number of square pilasters; 312 eight-inch round columns, and 149 twelve-inch square columns, for the galleries; 138 eight-inch square clerestory columns, and 160 ten-inch square columns, supporting the floors of the picture galleries; 62 round columns for supporting the roofs of the glass courts; (put all the columns end to end, and they would extend from the Exhibition building, either eastward as far as the London Docks, or westward as far as Kew, or northward as far as Hampstead, or southward to the Sydenham Crystal Palace); 1165 girders throughout, 11,600 feet of pipes, 15,000 feet of gutters, 14,000 feet of railings, 1000 brackets, 700 trusses and girders, 1400 shoes, &c.: the whole weigh nearly 4000 tons.

The wrought-iron has been supplied by the Thames Iron Company. This is used chiefly in the great domes, and for the roofs; it weighes about 1200 tons. The timber-work has been executed partly at Messrs Lucas's works at Lowestoft, and partly at Mr Kelk's works at the Grosvenor Canal. About 17,000 loads have been consumed. For the windows below the picture galleries there are 32 window-frames, 16 feet by 13 feet, and 68 window frames, 16 feet by 7 feet. For the top lighting of the galleries, 45,000 feet superficial of frames and glass are in preparation. For the clerestory lights of the nave and transepts, nearly a mile length of frames, 25 feet high, is used. The contract for the whole works has been taken by Messrs Kelk & Lucas, and is of a threefold character: for the use and waste of the buildings a sum of £200,000 is to be paid absolutely; if the receipts exceed £400,000, then the contractors are to take up to a further sum of £100,000; and if this sum is fully paid, then the centre area of the great picture galleries is to be left as the property of the Society of Arts. Lastly, the contractors are bound to sell absolutely the remaining rights over the buildings for a further sum of £130,000, which may possibly be paid by the surplus receipts of the Exhibition, if the success be great, of which there is a good prospect.

Such is an outline of the Exhibition works, which are alike creditable to the designer and builders. Captain Fowke has well accomplished a graceful and a useful task in thus letting us into the details of his great operations; and we now look forward with increasing interest to the time when we are promised the privilege of a close examination into what we are persuaded will be a world-wide collection of the leading examples of man's industry and taste.

THE NATIONAL DEFENCES. By George Parker Bidder, Jun., M.A. 8vo, pp. 199. Wood Engravings and Lithographs. London: 1861.

So much has been said as to wars and rumours of wars in our days—no matter whether our suspicions and misgivings are well or ill-founded—that it becomes us to look to our "national defences," and to see how we stand with reference to those of our neighbours of the earth who are reputed to view us with anything like a jealous eye. Mr Bidder comes before us then at a very proper time, for the purpose of aiding public discussion on such very important matters as the condition of our harbours and coast works, our armed shipping, and artillery. The volume which he has given us consists of an excerpt from the proceedings of the Institution of Civil Engineers, where the views of the author met with ample attention, and an extended discussion amongst many men of mark who have made such subjects their special study; and both the original paper and the practical opinions thus evoked, are presented under their present form, to enable the world at large to widen the field of consideration, and draw its own conclusions from the facts and suggestions necessarily arising from a preliminary examination under such weighty auspices.

Situated as we are, the matter is a most serious one; and when we come to reflect that, during the eight years between 1852 and 1861, the sum of £29,000,000 has been expended on the maintenance and re-construction alone of the Britith navy, exclusive of all items for pay, wages, dock-yard improvements, and other multifarious expenses connected with work involving so many ramifications, and that vessels, carrying an aggregate armament of more than 3,000 guns, have been launched within the same short period, the question does indeed seem to demand all the attention which we can bestow upon it.

Mr Bidder naturally opens his case by entering upon the consideration of the relative value of the navy and coast defences in preserving us from hostile inroads; and he, perhaps as naturally, arrives at the conclusion that, so long as we energetically preserve an efficient system of naval warfare by steam, so long will England be her own mistress. He then adverts to the prevailing system of building iron-plated war-ships, and suggests the possibility of producing a more formidable fleet by adopting the principle of protective armour on a more moderate scale, which, although inadequate to resist entirely heavy solid shot at short distances, would protect the vessels from shells and shots fired at long ranges. The argument here—and there is much to be said in favour of it—is, that by so doing, lighter and faster vessels, and more of them, could be built and fitted for the same money. The point, no doubt, after all, is, not to attempt the achievement of perfect safety, but to decide and act upon the particular thickness of defensive armour, which affords the maximum of general efficiency. It is quite clear to us, that the fate of most future naval engagements will be determined, to a far greater extent than is at present seriously thought of, by the number of comparatively small, very fast, low, and scantily rigged and heavily armed vessels which are employed. Steam rams, too, of which we have as yet but barely heard, may eventually form an important element in ocean fighting, for we think we have learnt enough to show what tremendous annihilative powers such floating structures must possess in opposition to ordinary war ships of even the largest size.

Mr Bidder's paper in itself, is but the text for a long and very diffuse sermon in the form of a full and elaborate discussion which took place between the President of the Institution, Mr S. P. Bidder, senr., Colonel Adair, Mr Scott Russell, Colonel Jervois, Commander Robt. Scott, Capt. Halsted, Mr Samuda, Admiral Sartorius, Mr Lawrence, Colonel Lysons, Captain W. S. Moorsom, Mr Conybeare, Sir W. Armstrong, Mr T. G. Harrison, Mr W. Clay, Colonel Simmons, Mr T. Aston, Mr J. A. Longridge, and Mr Hawkshaw—thus, in the midst of a variety of opinions touching to a large extent upon guns and projectiles—bringing out a mass of information, and a diffuse series of views which could hardly have been obtained in any other way. This was especially the case as regards gunnery—although we should have been better satisfied had Mr Whitworth been present, to say—as he could so well have said—so much upon this important subject. It will be enough for us to say that Sir W. Armstrong finally admitted the superior value—under many circumstances—of the muzzle as compared with the breech-loading principle, and that in comparing the Whitworth and the Armstrong gun, the President evidently leaned, as we supposed he would, to the Whitworth side.

THE CHANNEL RAILWAY, CONNECTING ENGLAND AND FRANCE. By James Chalmers. Large 8vo. Lithographs. Pp. 47. London: E. & F. N. Spon, 1861.

Give me £12,000,000—says Mr Chalmers—and I will give you a safe means of passing between England and France, through the shallow waters of the narrow channel, called of old, the straits of Dover—with the same ease and comfort to be met with in passing through a tunnel upon an ordinary surface line of railway. With his plan in practice, we are to have no embarking and disembarking in passing from shore to shore, with all the concomitant delays, troubles, and losses of luggage and—temper: no tossing about upon those ever troubled waters—of which, most of us have such a wholesome horror, and—no sea sickness. Here is a grand idea, and all is to be achieved by means of a simple continuous wrought-iron tube laid on the bottom surface of the channel ground and steadied by masses of rough stone, to act as a railway tunnel. With such a means of inter-communication, it would be possible to journey in the same railway carriage from the extreme north of Scotland into France, and thence, along the most distantly stretching continental lines. The abstract idea, of forming an unbroken link of connection between our little island and the endless continent, is not a new one. Tunnelling under the ordinary way; submerged tubes laid upon the bottom; an arched roadway or artificial tunnel upon the bottom, and a gigantic bridge over the water, have all been proposed, and all these notions have given birth to highly elaborated designs which evidenced the downright earnestness of their originators. But somehow, whether from a too early anticipation of the wants of the age, or from doubts on the part of the public, as to the commercially practicable nature of the schemes, we still rely upon our steamers for a means of interchanging visits with our continental neighbours, and we are still subject to all the ills which wind and water, and a disjointed system can inflict upon us. But *tempora mutantur et nos mutamur in illis*; the most serious restrictions upon our commercial as well as pleasurable intercourse with the continent have been removed; and, as Mr Chalmers very evidently thinks, the time appears to have come, when good engineering and good faith in its results may secure to us the long attempted boon.

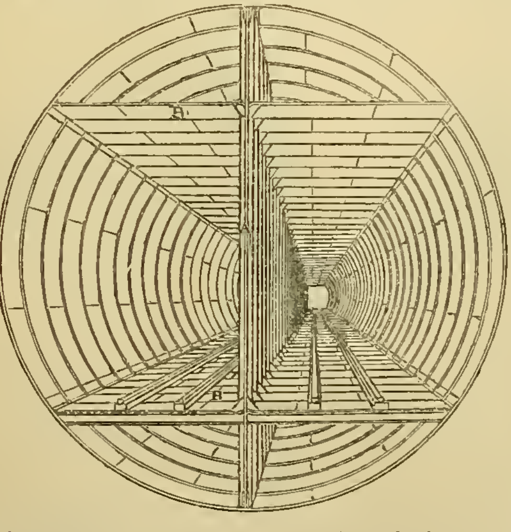
The respectable volume before us, presents his matured views on the subject, in a very plain, clear, and business-like way. Its six chapters, involve—an Introduction—the Valley, the Project, Capabilities, Principal Feature—Illustrations, Deep-Sea Ventilator—Estimates, Data, how obtained—Advantages to existing Railway Companies—Conclusion, Existing Works no criterion.

After disposing of all the previous plans which have come under his notice, which he does upon the whole, in as fair a manner as can be expected from the originator of a distinct and later project, we find his own introductory description to be as follows :—

"The principal feature of the work is simply a strong iron tube reaching from shore to shore in the still depths of the Channel, beyond the influence of the storms that render the sea dangerous on the surface. It is supported by its own buoyancy, having a powerful tendency to rise; and is kept down by anchors or boxes attached to and surrounding it, and filled with rough stone, both boxes and tube being covered by an embankment of similar material; and, as the current alternates up and down Channel with the rise and fall of the tide, the silt of the bottom carried by it against and into this embankment will fill up the interstices, and in a few years convert it into a solid impermeable mass having the appearance of a ridge reaching from shore to shore, about 150 feet wide at the base, 40 feet high, and from 40 to 120 feet below the level of low-water. In short, the materials of which this embankment will be formed, are the same as the French engineer proposed to use in forming his islands, through which he intended to penetrate to the bottom of the Channel.

"The tube will pass through three ventilators, one in mid-channel, and one about a mile from either shore: thus the main portion of the work will be 18 miles in length; and this divided by the deep-sea ventilator gives two sections of 9 miles each; consequently, a train can never be more than 4½ miles from an opening; and from this point will be carried to each opening flues connecting with a chimney rising nearly 300 feet above the level of the roadway at the middle, and 200 feet at the other ventilators; and to insure sufficient draft to clear away all smoke and foul air, powerful machinery will be employed, if necessary, to force air to the parts most distant from the ventilators; which, returning along the flues, will carry away the smoke and vapour left by a passing train, and keep the atmosphere within the tube pure and pleasant; while the cleanly-painted light coloured iron, and a thousand double lamps—one every 35 yards, will give a cheerful aspect to this ocean roadway, and render it an agreeable contrast to the noise and damp and darkness of an ordinary tunnel, or even the miles of uninviting scenery that often meet the eye in broad daylight. The noise in this tube can be reduced to the minimum; unlike tubular bridges suspended in the air, the sound and vibration of the iron will be deadened and neutralised by the equability and elasticity of the pressure without; and, as the situation of the roadway will admit of a perfectly-united rail, the sensation travellers will experience on entering the Channel Railway will be akin to what we feel, after walking on a gravelly road with thin shoes, when we step upon the downy sward of a smooth green lawn.

"The form of the tube is circular: it is made of iron plates similar to those used in building boilers or ships: the plates will be double-riveted and caulked; and the tube will be divided throughout its whole length by the vertical partition, A, in the cross sectional view annexed, made of similar plates; thus forming two roadways, one for eastward and one for westward traffic. It will be further strengthened by two horizontal subdivisions—the girders, 6 feet from the bottom, and the ceiling—this arrangement secures the ceilings and roadway, B. The ends of the central partition, the girders, and ceiling being connected with the tube at six points nearly equidistant, will effectually preserve its circular form. It is still further strengthened by ribs or circles of strong T-iron, rivetted to the plates, and forming unbroken arches within the tube. The partition is also supported by A, T-iron, and the ceiling has similar supports on its upper surface. The plates are calculated at 36 inches wide, lapping 3 inches, and two circles of T-iron are calculated for each plate; but I propose using three for deep-water tubes, two for medium, and one only for those in shallow water near shore: thus, with three ribs of 5 inch T-iron to each plate, the space between the top tables, or part of the T-iron riveted to the plates, will only be 6 inches, or 11 inches from centre to centre of the ribs—the T-iron and laps exactly equalling in extent the interior surface of the tube, thus, as it were, doubling its thickness, and, by the form adopted, more than trebling its strength. The interior supports just described—the partition, girders, and ceiling—sustaining the tube at six points of its circumference, and the exterior support it will receive at ten points of its length from the sides of the iron boxes attached to, and surrounding it, will render it the strongest and most economical tube that can be made to resist the combined forces of compression and lateral strain. These tubes may be built in any harbour, or on the banks of any river, in either country, within reasonable distance of their destination.



"The ventilators will be circular masses of iron and stone, of which a detailed description is given hereafter: the one in mid-channel, when finished, will weigh over 100,000 tons, and displace 58,448 tons of water; the depth where it will be placed being 28 fathoms, = 168 feet: about 50 feet from the bottom, it will be surrounded by, and embedded in the embankment that covers the tube; and, as the storms that trouble the surface of the waters do not agitate them to a depth of more than 30 feet, 138 feet of the height of this massive tower will be surrounded and sustained by a weighty body of water in a quiescent state; and that portion of it exposed to the action of the sea will have little to withstand: the waves are only powerful when resisted: around the smooth iron sides of this round structure they will part and pass onwards: they will have four directions in which to expend their strength—upwards, downwards, and on either side; and the upward spray will be thrown back into the sea by the projecting curve with which the wall of the ventilator finishes above. The other ventilators, of similar construction, will stand in 12 fathoms, about a mile from either shore: the tubes will be attached to the ventilators near the bottom: those connecting the ventilators with the shores will be covered by an embankment rising above the level of low-water, effectually protecting them in the shallow waters near shore from contact with ships, or injury from any other cause. From the point where the tube connects with the shore, a tunnel will be driven to that selected for the entrance."

The Channel Railway, including four miles of tunnel-approaches, will cost £500,000 per mile, = £94 14s. per foot. The bridges that span the Thames in many instances cost five, and in some cases nearly ten times this amount. This extraordinary economy in expenditure, this almost absurd lowness of cost, is mainly due to the fact that the tube, the principal feature of the work, requires no expensive wrought stone-work, or expensive material to support it, or expensive skilled labour to put such materials together.

This is the general detail of the scheme; for the proposed mode of constructing the ventilator towers, and floating and sinking the lengths of tube, we must refer inquirers to the volume itself. It is here, however, that, apart from the enormous first cost of the project, Mr Chalmers will, we think, meet with his great practical difficulties, not the least of which will be, first the submerging the tube lengths, in anything like even line—and second, the keeping the whole length steadily down when the contained water is exhausted, and the enormous upward buoyant pressure comes into operation.

As to the financial view of the matter, Mr Chalmers calculates his annual receipts at £1,300,000, and his working expenses—the tube being taken simply as a bridge on which passing tolls are receivable—at £85,000, or something like ten per cent. upon the invested capital; we leave this question to the consideration of capitalists.

The thing may be possible, and as much so according to our author's plans, as by any other of which we have any account. It would be an imposing result to achieve. We wish the present projector a real success. In all such projects as this, however, success, or even the attempt to succeed, does not rest upon the common cant, that "the word impossible is no longer known to engineers," &c. In one sense, and in that only, is it radically true of any project great or small, that it is "not impossible," namely, when, according to the knowledge we have aforehand, we can certainly predicate that it does not conflict with the laws of nature. But even this being so, if the project demand the combined desires and efforts of a large section of mankind to bring it to a concrete existence, the real question of possibility, or the contrary, resolve itself into this—is the pressure of desire, or want for it, sufficient to combine the many, and to evolve their powers upon the single object: and this at last becomes the old vulgar inquiry, Will it pay?—pay in the very largest sense if you will—nationally or individually. Brought down to this sublunary standard, we confess we do not think the difference between running twenty miles in damp and twilight, in place of steaming even with sea sickness for two hours, will be thought worth even £12,000,000.

MECHANIC'S LIBRARY.

Art Journal, Vol. 1861, 4to 31s 6d, cloth.
Astronomical Discourses, 12mo, 1s, swd. Chalmers.
Abbeys and Attics, 2 vols, post 8vo, 12s, cloth.. Strickland.
Botany, Aids to the Study of, translated by Strauss, 8vo, 3s 6d. cloth. Arendt.
Botany, Manual of Structural, illustrated, fc 8vo, 1s, sewed. Cooke.
Calculator, Fractional, 5th ed, 12mo, 4s, hf. bd. Page.
Geometrical Drawing, Elements of, part 1, fol., 16s, hf. bd. Bradley.
Literary and Scientific Register and Almanac for 1862, 3s 6d, boards. Gutch.
Mathematics, Formula in Pure and Mixed, fc. 8vo, 3s Edwards.
Metallurgy, Manual of, crown 8vo, 12s, cloth. Makin.
Metallurgy: Extracting Metals from their Ores, &c., 8vo. 21s. Percy.
Pin, History of a, with illustrations by Ross, 8vo, 3s 6d, cloth.
Painting in Water Colours, English School of, £4 4s, cl. Penley.
Photographs from Thirty Drawings: Liber Studiorum, 73s 6d, boards. Turner.
Ship, History of a, from her Cradle to her Grave, new edition, 16mo. 3s.
Scientific Class-Book, Baker's Circle of Knowledge, part 4, fc. 8vo, 4s 6d.

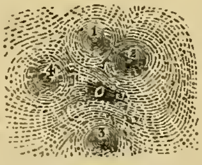
CORRESPONDENCE.

MAGNETICAL DEVIATIONS OF THE COMPASS.

VI.

We will now proceed to inquire respecting the magnetical condition of iron ships. The most distinctive effective energy is a strong polar magnetism induced from position. 1st, Polar magnetism from position, that is iron which is upright, or nearly so, partakes of a distinct polar action, which continues to act in whatever position the ship's head may be placed, and only becomes changed when the ship removes from the one hemisphere to the other, this change simply reversing the polarity. 2d, Physically induced magnetism, that is, magnetism induced by physical or mechanical power while the ship is building. This magnetism will remain permanent for a considerable time, the time depending upon the hardness the iron may have acquired in working it into form. This magnetism can only be changed when the ship undergoes some great physical change.

In order that we may form a better idea, let us suppose a number of upright bars, their poles being south (see annexed engraving). It will be observed, that a current or flow from each bar seems to repel each other. Suppose the bar 3 to be changed to a north pole, the flow of the others would set in this direction, thus apparently weakening the energy of the others. Again, suppose the bar marked 1 to be also changed to a north pole: from this it will be evident that there will be a point or focus where the combined energies will be in equilibrium, this point is at o. If a compass was placed at this point, its indications would not be disturbed: from this, then, we can perceive that the energy may be made to flow so that it would not disturb the indications of the compass. From this it would appear—



1st, That the deviations of the compass are caused by the dominancy of one or other of the polarities. This dominancy may be equalised by the opposite polarity, *or the currents running counter and meeting produce an equilibrium.*

2d, To the combined magnetic power or energy may be assigned different degrees of action, as direction, dip, intensity; these arising from the position of the disturbing influence. This combined influence or energy radiating at all times in some particular direction.

3d, When a compass is placed within the magnetic rays there is a magnetic focus formed between them, which can be ascertained. A magnet of sufficient power placed in the centre or focus would counterpoise the dominant pole, so that the compass would indicate correctly, *thus again showing that the currents are equalised.*

The method of correcting the deviations of the compass in iron ships by a combination of magnets has been practised for upwards of twenty years; and the fact cannot be disputed that this mode of adjustment falls far short of the desired end. This fact is well known to the experienced commander as well as to the adjuster. It is true that where the deviations are not extreme, and the ship not making any considerable change in latitude, the compasses may be adjusted, and continue to indicate for a time pretty correctly; but with ships that require to change their latitude considerably, correct indications can never be depended upon.

It will be found by experience that in all adjustments by a combination of magnets, some particular point will be considerably out, and the application of chain boxes does not at all times improve it. This, then, is the error of adjustments by combined magnets. How long are we to continue the use of a combination of magnets? We may be informed that magnetism has two distinctive impelling forces, and that it is necessary to counterpose it by a combination of forces. Such is the present philosophy of compass adjustment.

We think that, as long as the adjustment of ship's compasses is effected by a combination of magnets, the commander never can be in a position, when placed under difficulties by compass indications, to do anything to assist himself. From practical experience, we know that, when a combination of magnets is applied, if one of them agnets is wrong, then the whole adjustment is destroyed. From this, it must be evident that the commander is in no better position to-day than he was twenty years ago. How long is this to continue? For there cannot be a doubt that our knowledge of magnetism is greatly extended within the last few years, and still, with that advancement of our knowledge in the science, a combination of magnets is still contended for. As long as a combination is applied to the adjustment of the compass the uncertainty of compass indications will continue. Throughout these papers, I have endeavoured to reason on magnetism as a current of energy constantly flowing in one particular direction, and that this current may be made to indicate an equilibrium by an opposite current. In the adjustment of ship's compasses, it would be well for those who contend for a combination of magnets not to proceed in their process of reasoning from the general principles of magnetism, as viewed to be two distinct forces or principles of energy, so far as the adjustment of compasses are concerned. Suppose that, for a time, we keep what are termed the fundamental principles of magnetism out of view, and that we begin with the deviations of the compass as indicated in the iron ship. This may be viewed as beginning at the wrong end, but, by this means, we may be enabled to go back to first principles. Then let us suppose that we endeavour to imitate the deviations as indicated by the card. We know that we can produce deviations similar to those indicated in an iron ship by a single magnet. Then why do we continue to use a combination of magnets, if we can produce similar deviations by a single magnet? This view of the questions is not theoretical, but the result of many years' practical experience. The intelligent commander can, at all times, assist himself when a single magnet is used, so that his compasses would faithfully indicate the true course, and thus make his position as good as if in a wooden ship. It is high time that something was done, as we are apparently within a few years of all ships being built of iron.

Paul Cameron.

ASTRO-METEOROLOGY.

Sir,—A few days ago, a gentleman, who has written on "*Astro*-meteorology," ventured to predict that a storm would occur about the 17th or 18th of this month.

In consequence of this prediction appearing in several papers, application has just been made to me, by the captain of a ship preparing to sail, to know whether such an occurrence is expected, and was thus foretold, by this department.

Having explained why it is impossible to foretell or predict accurately any particular weather, at an interval of time exceeding two or there days in advance, and having assured him that no such far-seen prediction as that of the 10th inst., *adverting to the 17th*, would have been ventured on at this office—simply because we *could not* have facts on which it might be based, even approximately, I feel it a duty to ask your assistance in attempting to caution some persons against the perhaps apparently plausible assertions of writers who mysteriously refer atmospheric changes to the relative positions of Jupiter, Venus, and Saturn, but are ridiculed by really scientific men.

While thus troublesome, may I bore you further, for the benefit of others, by remarking that there are numerous venders of very inferior meteorological instruments, who assert that they are those, or similar to those verified at Kew, or supplied to Government, although the fact is that they are not so, but are as objectionable as bad watches or cheap razors, which may deceive till proved?

There are but few reliable manufacturers of accurate meteorological instruments, and they are well known in Europe, America, Australia, and India.

Faithfully yours,
ROBERT FITZROY.

Meteorological Department,
2 Parliament Street, S.W., December 15.

FEATHERING PADDLE-WHEELS.

I enclose you a rough sketch of a side paddle I invented a few months ago. I have found out that not one in a hundred (to speak within bounds) reap any benefit by inventions, so you are at liberty to publish it in your *Journal* if you think proper. That marked No. 1, I have applied to a small boat, which works admirably. You will see that the paddle-blades lift over one another partially, so that twice the breadth and the width of the middle crank is the room required to work in. They throw no backwater, and having a great dip, work well, running in a hollow sea, and have less slip than wheels. No. 2 form of paddles, with duplicate cranks, do away with all leverage, and brings the power direct to its work. Any other information I am possessed of is at your service. S. Schllick.

Fleetwood, December, 1861.

[We cannot undertake to publish our correspondent's sketches. He says, "not one inventor in a hundred reaps the benefit of his inventive ability." This is probably even below the entire truth; but if our correspondent will think more maturely, he will discover that he himself gives an example of the most common of the many causes leading to this result.

To invent successfully as respects remuneration, it is not only necessary to know "how to invent," but "what to invent," and for the latter we must not only invent what people want, but what has not been invented before. Now if our correspondent will turn back to the old patent journals of a quarter of a century ago, he will find that his paddle-wheels (new no doubt to him) are in principle, and almost identically in detail, "Steven's Patent Paddles," long ago tried and found wanting.]—Ed. *P. M. Journal.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH HOROLOGICAL INSTITUTE.

September 18, 1861.

"On Barometers: their Construction, Use, and Recent Improvements." By Mr R. Strachan.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

October 31, 1861.

"On Steam Fire Engines." By Mr C. B. King.

November 7, 1861.

"On the Various Methods of Sinking Iron Cylinders for Foundations." By J. B. Walton.

SOCIETY OF ENGINEERS.

November 4, 1861.

"On Surface Condensers." By John Lough.

INSTITUTION OF MECHANICAL ENGINEERS.

November 7, 1861.

"On a Rivet-Making Machine." By Mr C. De Bergue.

"On an Application of Gifford's Injector as an Elevator for the Drainage of Pit Workings." By Mr C. W. Wardle, Leeds.

This application of the injector was suggested by the author for the purpose of working out a small portion of the Kippax Colliery, near Leeds, which lay below the main drainage level of the colliery, and at a considerable distance from the shaft; the extent to be worked was so limited that it did not allow of the erection of a special pumping engine, and hand pumping was employed until the water had increased in the workings to such an extent that it could not be kept down by this means. The present elevator was then applied, consisting of a simple form of the injector used for feeding steam boilers, in which the steam and water orifices are fixed at the position suitable for the height of lift and pressure of steam, no adjusting handles or valve being used. The steam is supplied from a boiler at the surface of the ground, and is conveyed by a 1½-inch gas pipe down through the pit to the elevator, at a total distance of more than 1000 feet from the boiler; and the water is delivered up an inclined pipe from the elevator for a distance of 300 feet, being raised a height of 27 feet. In order to separate the steam before it enters the elevator from the condensed water produced by its passage through the long length of steam pipe, it is passed through the top of a depositing box, in which the condensed water collects, and flows thence into a self-acting water trap, by which it is discharged at regular intervals. This serves quite efficiently for keeping the steam supplied to the elevator free from water, and the elevator continues working uninterruptedly for many hours together; and when the quantity of drainage water is sufficient, it works continuously day and night without stoppage. It does not require any attention in working, and is started by simply turning on the steam at the boiler at top. The elevator has now been at work at this colliery with complete success for several months past, and has proved a simple and efficient means of drainage; and, although far from an economical application of steam, is less expensive in this instance than any other plan, since the fuel employed for raising the steam is only refuse slack from the pit, for which there is no other use, and no other cost of working is incurred. The elevator is now being applied also for raising the water supplied for cooling the tuyeres of blast furnaces, and is in use at other works for filling up the water tanks during the night for the day's supply, making use of the waste steam previously thrown away from boilers heated by forge furnaces. It avoids the liabilities to stoppage attending the working of pumps, and is not injured by frost, but gets thawed by the heat of the steam, and quickly starts working, even when it has been completely frozen up.

ASTRONOMICAL SOCIETY.

November 8, 1861.

"On an Instrument for comparing Colours, proposed to be designated a Homochromoscope." By Mr W. R. Birt.

"On a new Observing Clock." By Prof. C. Piazzi Smyth.

INSTITUTION OF CIVIL ENGINEERS.

November 12, 1861.

"On the Hooghly and the Mutla." By Mr J. A. Longridge.

The subject was divided into the following heads:—First, a statement of the commercial importance of the port of Calcutta. Secondly, a brief account of the present mode of transport of the traffic to the port, and the modification of it, by works now in progress. Thirdly, a sketch of the physical features of the two outlets, the Hooghly and the Mutla. Fourthly, remarks on the past and present state of those rivers, as navigable channels, together with a consideration of remedial measures.

December, 10, 1861.

Discussion on Mr Bailey Denton's Paper.

GLASGOW PHILOSOPHICAL SOCIETY.

November 20, 1861.

The President, Mr Rankine, delivered a comprehensive address "On the Recent Progress of Mechanical Science."

CHEMICAL SOCIETY.

December 5, 1861.

"On Peppermint Camphor," by Dr Oppenheim; "On Piperic and Hydropiperic Acids, by Mr G. C. Foster; "On the Power ascribed to the Roots of Plants of rejecting Poisons and other abnormal Substances presented to them," by Dr Daubeny; "On some Physical Properties of Tin-Lead Alloys," and "On the Dangers arising from the Use of certain Waters for Feeding Steam-engine Boilers," by by Prof. Balley. In this last paper, the author described two cases, in which, owing to the presence of fatty matter in the waters, deposits of carbonate of lime were not pulverulent, as usual, but assumed the form of hard cakes, impervious to water, so that those portions of the boilers on which they rested were liable to become red-hot.

SOCIETY OF ARTS.

December 11, 1861.

"On Railway Management, from the Passengers' point of view," by Mr T. Baker. The author said that at the time of the Exhibition of 1851, the railway termini in the Metropolis were capable of daily delivering and returning 40,000 passengers; but that the Exhibition of 1862 would find the capabilities of the London railways so extended, that instead of 40,000, upwards of 140,000 people might be carried to and fro every day. The effective management of railways became, therefore, a matter of national importance, both as bearing on the question of the comfort and safety of the passengers and the payment of fair dividends to the shareholders. The author touched on some of the principal reasons why ordinary railway traffic was not more largely increased; among which he referred to the inconveniences brought about by the disputes of rival companies in not running trains to suit each other, and the high rates of the ordinary fares, while the excursion fares, were in his opinion, often unnecessarily low. But the point to which he especially directed attention was that persons who were in the habit of travelling constantly found the violent shaking injurious to their health. The author mentioned numerous instances within his own knowledge of persons who had been obliged to give up the habit of travelling daily, owing to the effect of the vibration on the spine and nervous system. What appeared to confirm the author's view most strongly was the remarkable fact, that there were fewer season tickets by 2,000 issued in 1860 than in 1859, as shown by the Board of Trade returns. It was suggested that the present carriages were too much like those used on common roads, and that a totally different method of construction, might advantageously be adopted. Various suggestions as to modifying the present springs and generally making the carriages much less rigid, so as to avoid the very serious evil above referred to, were put forward by the author, who also touched upon numerous other inconveniences of railway travelling which might be obviated.

ROYAL SOCIETY.

December 13, 1861.

The Copley Medal, in the gift of the Royal Society, has been awarded by the Council to the celebrated Agassiz, thus setting the seal to the opinion which has so long prevailed as to the merits of the distinguished Professor. One of the Royal Medals has been awarded to Dr Carpenter, F.R.S., for his researches on the Foraminifera, into the Structure of Shell, and the Embryonic Development of Purpura, besides his other works on Physiology and Comparative Anatomy. The other Royal Medal is awarded to Prof. J. J. Sylvester, F.R.S., of the Royal Military Academy, Woolwich, for his important contributions to Mathematical Science.

MONTHLY NOTES.

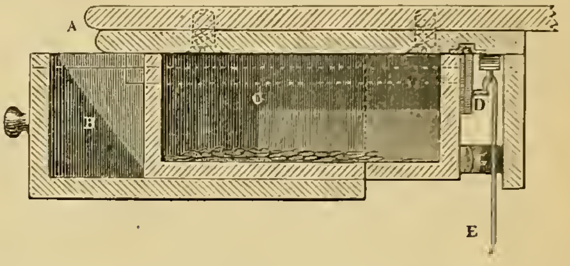
MISCELLANEOUS.

Perforating Glass by an Electric Spark.—A curious experiment has recently been performed by M. Faye, by which he is enabled to pierce thick pieces of glass by means of an electric spark. That glass can be broken by an electric spark has long been known, but M. Faye has now succeeded in piercing extremely thick plates by the powerful flash from a very large Rhumkorf's coil. The results were laid before the last meeting of the Paris Academy of Sciences. No traces of fusion were discernible.

New Iron Bridge over the Mersey.—The eminent firm of Messrs Edward T. Bellhouse, of the Eagle Foundry, Manchester, have recently erected a handsome and convenient foot bridge over the Mersey, at Northenden. The bridge spans the river by means of two wrought iron lattice girders, of ornamental open design, the width of the river being nearly 85 feet. Each girder is 88 feet long, six feet deep in the centre, and two feet six inches deep at the ends; the space between the two girders is six feet, which is filled in with cross beams and planks, forming the footway. The bridge is carried upon eight cast-iron piles, four at each end, which are eight inches in diameter, driven about sixteen feet into the ground. The footpath is continued to the top of the bank on each side of the river by iron beams, planking, and railing. There are two arches of cast-iron, with shields having the armorial bearings of the Withenshaw family thereupon, connecting the upper parts of the lattice girders; and in one of these there is an iron openwork gate. The design is exceedingly chaste, and the whole structure reflects great credit upon the engineers. The neighbourhood is indebted to the liberality of T. W. Tattom, Esq., of Withenshaw Hall, for this bridge, which is designed to supersede the old ferry-boat conveyance.

Indian Cotton for Spinning High Numbers.—Surât and other Indian cotton, long used for mixing with better qualities and longer staples, is now, under the continued pressure of sheer necessity, attracting great attention in our large manufacturing centres, with a view to its more extended use for textile purposes. Throughout the Lancashire cotton districts the spinners are now generally making experiments with Indian cotton, and although the opinions expressed as to the result are various, it is evident that, by a slight alteration in the machinery, this cotton may be made to enter, in various proportions, into much higher numbers than has hitherto been anticipated. We have very little doubt as to the ultimate success of such efforts. Much may thus be done to avoid the serious effects of the existing dearth in what we have hitherto considered as almost our only workable material, American cotton. Another illustration of the effect of the present state of things in draining supplies of cotton from new sources, is to be found in what is doing in Russia, in obtaining the raw material from Khiva and Bokhara. The quantity brought from these districts, to the fair of Novgorod, was 18,000 cwt., about three per cent. of the entire annual Russian consumption. This does not look very much, but the supply is large enough to indicate a strong probability of the amount being largely increased very soon—the more so as a further consignment of 36,000 cwt. was very shortly expected. Hitherto, the aggregate annual value of the Russian trade with Khiva and Bokhara, in every kind of goods, has been estimated at but £240,000, but now cotton alone is likely to figure for at least £150,000. The aggregate importation of cotton into this country, during the last ten months, proves to be about the same as usual; and the last month shows a positive increase. The plain English of this is, that to India we are actually indebted for very nearly the amount deficient in the American material. In the longer period, nearly two-sevenths of our whole cotton supply was derived from the British East Indies; in the shorter period, 467,578 cwt. came thence, and less than 20,000 cwt. from all countries put together; and if we substitute value for quantity, we obtain a still more striking result. But, in taking more Indian cotton, we take less silk. Comparing the present year with 1859 60, the importation of raw silk has somewhat diminished, and the trade in Indian silk manufactures has positively dwindled to less than one-third of its former extent; and a more than equivalent impulse has been given to the importation of silks of European manufacture.

Safety Till.—Mr Webb, of 6 Artillery Terrace, Westminster, has recently patented a very simple and efficient "safety till," which will prove valuable to shopkeepers in protecting them from the depredations of light-fingered gentry who, during the temporary absence of supervision, enter shops, extract money from the till by the very simple process of leaning over the counter, pulling open the money drawer, and helping themselves to the contents. It struck Mr Webb that if he could so construct a till that no money would be visible when the till is opened in the usual manner, by pulling the drawer from the front of the counter only, an effective check on such robberies would be obtained. Our illustration represents a transverse section of the top of a shop counter, showing Mr Webb's safety till in longitudinal section. A is the top of the counter, to the under side of which is secured the safety till. This till consists of an outer drawer, B, sliding in ordinary guides, and having an inner drawer, C, fitting accurately within it by slight friction, which should be sufficient to enable it to be drawn out with the outer drawer when desired. The outer drawer is made without a back, so that it may be free to be drawn, and leaving the inner drawer behind when required. The inner drawer which receives the money is locked at the back or inner end by a spring catch at D, which may be relieved at pleasure by depressing a foot lever placed below the counter in connection with the spring catch by means of the rod, E. The upper end of the rod, E, is attached to a spring, secured under the top of the counter, and the end of the rod is bent so as to rest upon the pin or button of the spring catch. Thus, in order to unlock the till, it is requisite to depress the foot lever before mentioned, which can only be done from the inner side of the counter. When the till proper, or inner drawer, is locked by the spring catch, it cannot of course be drawn or slid out in company with the outer drawer, but remains concealed underneath the counter, whilst the outer drawer, which is always free to be opened or slid out, will of course present the appearance of an empty till, to the great edification no doubt of the would-be thief! When the real till is to be opened, the foot is pressed on the lever, and a blade spring, G, immediately forces it forward, or starts the now released inner drawer, and with it the outer one, when the two may be drawn open together as an ordinary drawer.



Japanning.—*Japanning* is a method of varnishing or lackering articles in metal, wood, and other materials, originally practised by the Japanese, with a peculiar lacker, the juice of a tree which grows in the Japanese island. This juice is obtained by making incisions in the lower part of the trunk; it looks like cream when first oozing out, but turns speedily black in the air. The dried juice, which possesses the property of hardening better than any other lacker, is occasionally brought over to this country, but hardly ever employed now in the process of japanning as practised here, which differs from the ordinary method of varnishing simply in this, that after the application of every coat of colour or varnish, the object so coloured or varnished is dried in an oven or chamber, called a stove, and heated by flues to as high a temperature as can safely be employed without injuring the articles, or causing the varnish to blister or run. By this method two objects are attained, viz., in the first place, all articles so japanned, or, to use the technical term, "stoved," are more durable than they would be if simply left to dry in the air; and, in the second place, a considerable saving of time is effected, which tends to cheapen the cost of the goods. For black grounds, drop ivory-black mixed with dark coloured animé varnish is used; for coloured grounds, the ordinary painter's colours, ground with linseed oil or turpentine, and mixed with animé varnish. The colours most in use are White lead, Cobalt blue, King's yellow, vermilion (used more particularly to imitate tortoise-shell,) Indian red, verdigris, umber, and the intermediate tints produced by mixing two or several of them together. The varnishes most used are animé and copal. The grounds and varnishes are generally laid on with painting brushes, or flat brushes, made of fine soft bristles. Tin-plate articles intended for japanning, are first thoroughly cleansed from every trace of grease that may adhere to them, with turpentine or spirits of tar, then rubbed with sand-paper. They are then ready to receive the first coat, after which they are thoroughly dried in the stove. For black japanned works, the ground is prepared with a coating of black made as just now stated, by mixing drop ivory-black with dark coloured animé varnish, which gives a blacker surface than would be produced by the japan alone; and the object is then dried in the stove. From three to six coats of japan are afterwards successively applied, the work being always thoroughly dried again in the stove between the laying on of every fresh coat. For brown japanned works, umber is mixed with the japan to give the required tint, the process in all other respects being the same as for black japanned works. For coloured works, no japan is used, but they are simply painted with the ordinary painter's colours, prepared as just now stated. The colours are protected against atmospheric influences, and made to shine with greater brilliancy, by two or three coats of copal or animé varnish. Superior articles receive as many as five or six coats of varnish, and are finally polished. The ornamentation of all such articles as come under the head of Toilet Wares, is effected by the ordinary mode of painting with the camel's hair pencil, or some fitting substitute; where imitations of woods or marble is intended, the ordinary grainer's tools are used. Many patterns are produced upon the various articles by a process identical with that employed in the potteries, viz., by what is technically called "*transfer printing.*" The designs are etched on copper-plates, and printed on a species of tissue paper in the required colour, the paper is then placed with the printed side upon the part of the object which it is intended to ornament, and rubbed down upon it with a flannel rubber; the paper is then washed away with water, which leaves the design intact. The composition of the ink or colour used for transfer printing is a subject on which it would appear some mystery is affected by the printers; there can be no doubt, however, that boiled linseed oil forms one of the chief ingredients. Gilding is executed by pencilling the design on the object with japanner's gold size, and when this is nearly dry, but still clammy, covering it with gold-leaf, burnishing with agate or bloodstone, and highly varnishing with copal varnish. The parts which are to be in dead gold (called *matt*,) are left unburnished, and a thin coat of size or glue, slightly warmed, is passsed over them.—*The Ironmonger.*

Papier Mache.—There are at present five principal varieties of *papier mâche* known in the trade, viz., 1. Sheets of paper pasted together upon models; 2. Thick sheets or boards produced by pressing ordinary paper pulp between dies; 3. *Fibrous slab*, which is made of the coarse varieties of fibre only, mixed with some earthy matter, and certain chemical agents introduced for the purpose of rendering the mass incombustible; a cementing size is added, and the whole well kneaded together with the aid of steam. The kneaded mass is passed repeatedly through iron rollers, which squeezes it to a perfectly uniform thickness; it is then dried at a proper temperature; 4. *Carton pierre*, which is made of pulp of paper mixed with whiting and glue, pressed into plaster piece-moulds, backed with paper, and, when sufficiently set, hardened by drying in a hot room; 5. *Martin's Ceramic papier mâche*, a new composition, patented in 1858, which consists of paper pulp, rosin, glue, drying oil, and sugar of lead, mixed in certain fixed proportions, and kneaded together; this composition is extremely plastic, and may be worked, pressed, or moulded into any required form. It may be preserved in this plastic condition for several months by keeping the air away, and occasionally kneading the mass. The first mentioned variety of *papier mâche* alone engages our attention here. A special kind of paper, of a porous texture, is manufactured for this purpose. An iron mould of somewhat smaller size than the object required is greased with Russian tallow, a sheet of the paper is laid on to the greased surface of the mould, and covered over with a coat of paste made of the best biscuit flour and glue, which is spread evenly all over the sheet with the hands, another sheet is then laid on, and rubbed down evenly, so that the two sheets are closely pasted together at all points. After this the mould is taken to the drying chamber, where it is exposed to a temperature of about 120°; when quite dry, which it takes several hours to accomplish, it is carried back to the pasting-room, and another sheet laid on with another coat of paste, after which it is returned to the drying chamber, and the same operation is repeated over and over again until sufficient thickness is attained, which for superior articles, such as are manufactured at these works, requires from thirty to forty sheets of paper, and of course as many coats of paste between. The shell is then removed from the mould, and planed to shape with a carpenter's plane, after which it is dipped in linseed oil and spirits of tar to harden it; this changes the colour from grey to a dingy yellowish-brown tint. The article is then stoved, and seven or eight coats of varnish are laid on (with a stoving after each,) which are cleared off each time, any inequalities of surface being finally removed with pumice-stone. The number of drying processes the articles have to go through consume so much time that it takes three or four weeks to fit them for ornamentation, which is applied in bronze-powder, gold or colour, and for many articles also in mother-of-pearl. The ornamentation of these articles is sometimes effected in the highest style of the painter's art. The gold leaf is laid on with a solution of isinglass in water, the design then pencilled on with asphaltum, the superfluous gold removed with a dossil of cotton dipped in water, which leaves intact the parts touched with asphaltum, and the latter finally removed with essence of turpentine. The cotton pledgets used are of course carefully collected, to recover the gold removed by them. Several coats of shellac varnish are now put on, and the article is stoved at a heat of 280° Fahrenheit, after which it is polished with rotten stone and oil, and to a brilliant surface by hand-rubbing. Designs in mother-of-pearl are laid on with black varnish, the article is then varnished all over, and the varnish removed afterwards from the design with pumice-stone; a new coat of varnish is then laid on, and the part covering the design again removed with pumice-stone, and the same operation is repeated, the varnish being always removed from over the design with pumice-stone after each fresh coat, until it rises level with the design, which it generally takes from eight to ten coats of varnish to accomplish. Ornamental lines, writing &c., are put on with colour. The inlaying with mother-of-pearl is a most laborious process, owing to the small size of the pieces at the artist's disposal, and the necessity of attending to a proper distribution and fitting of lights and shades, lest a mere gaudy daub should be produced in lieu of a tasteful design. Objects ornamented with mother-of-pearl are subsequently coated with several layers of shellac varnish, stoved, and polished.—*The Ironmonger.* [It is much to be regretted that the singular and abundant native varnishes, or natural japans, brought into notice some years ago by the late Dr Royle, E.I.C., Service, which are used to an immense extent in India for their lacquered ware, and known there as sylhet varnish, (the juice of several species of the genus "Hologarna,") have not been imported, and trials made upon a manufacturing scale of their properties. Might not some of these give us a better insulating material for marine telegraph cables than we as yet are acquainted with.—*Ed.*]

Tin-plate.—Tin-plate consists of sheet iron, rolled out to various degrees of thinness, and coated on both sides with a layer of tin, which forms with the iron an alloy uniting the useful qualities of both metals. The best sheet iron *(charcoal iron)* is used for tin-plates.. The sheet iron coming from the plate mill is cut with shears into rectangular plates of different sizes, which are piled, with a little sawdust sprinkled between each plate, to keep them separate; the pile is immersed in dilute sulphuric acid, an operation which is technically termed "pickling." In four or five minutes the plates are taken out of the pickle, piled on a stand, covered with a cast iron box, termed an *annealing-pot*, and exposed in this to a dull red heat in a reverberatory furnace for twenty-four hours. This process of annealing, first introduced by Mr Thomas Morgan, in 1829, is a vast improvement upon the old method of bending each plate separately by hand into a saddle, forming two sides of a triangle, and placing the bent plates in the furnace. The annealed plates, when cold, are passed between hard polished rollers; this process of cold-rolling, it would appear, tends to "harden" the metal a little too much, and to impair in some slight degree its ductility; to remedy this defect, therefore, the plates are annealed again at a low heat; after which they are washed in dilute sulphuric acid to clean away the scales of oxide of iron that may have formed on the surface; this latter operation is assisted by a gentle heat of 90 or 100° Fahr., for which purpose the leaden cistern containing the pickle is generally placed over a heated flue. Care must be taken not to leave the plates too long in the pickle, lest they should become stained or *blistered.* From the pickle the plates are transferred to a cistern filled with clean water, and scoured with sand and hemp or hurds. The plates are now perfectly bright and chemically clean on the surface, which is an indispensable condition for the adhesion of the tin. In this state they may be kept for months immersed in pure water without rusting; but a few minutes' exposure to the air rusts them. The process of tinning is conducted in a building called the *stow*, especially fitted for the purpose. It contains six cast iron vessels of various sizes, with proper fire places beneath each of them. These vessels, technically termed "pots," are arranged in a row from right to left. The extreme right is occupied by the first pot, called the *Tinman's-pan*, which is full of melted grease; the plates having been taken to the stow, with all proper care to keep the surface perfectly bright and chemically clean, are immersed in this grease pot (No. 1,) and left there until all aqueous moisture is evaporated upon them, and they are completely covered with the grease. After this they are taken to the second pot, called the *Tin-pot*, containing a melted mass of about ten cwt. of block and grain-tin, in nearly equal proportions, covered with a layer of melted tallow, about four inches deep, to protect the molten metal from contact with the air; into this bath the greased plates are plunged in a vertical position to the number of several hundreds, and kept there for a space of time varying from one to two hours, the bath being kept at as high temperature as it will bear without firing the grease. As the surface is not uniformly covered in this first dipping, the plates are transferred from the tin-pot to another vessel, called the *washing* or *dipping-pot;* this is divided into two compartments, a larger and a smaller, each of them containing a bath of molten tin (best grain-tin) covered with grease. The plates are plunged first into the bath in the larger compartment, and left there a sufficient time to get the surfaces uniformly coated with tin. A long table stands between the *tin-pot* and the *dipping-pot;* to this the plates are now removed for the purpose of being wiped on both sides with a hempen brush, after which they are dipped in the second compartment of the wash-pot, which contains the purest tin. After the washing of a certain number of plates, say 15,000, the contents of the second compartment, having suffered some deterioration from becoming mixed with a slight proportion of the iron and tin alloy formed, are removed to the first compartment, and thence again to the tin-pot, the wash-pot being replenished with a fresh quantity of grain-tin. The tinning is now complete, but the plates still require a species of annealing, to prevent the alloy on the surface of the plate cooling quicker than the iron, or otherwise the face of the plate would be sure to be cracked; besides, the superfluous tin must also be allowed to run off. For this purpose the plates are removed to a large cast iron vessel, called the *Grease-pot* (grease-pot No. 2,) which contains clean melted tallow, or unsalted lard; this part of the operation requires the neatest management as to the temperature of the grease, which must be neither too high nor too low for the intended purpose. The pot has pins fixed within it to keep the plates asunder; as soon as five plates have been transferred to it, the lad who assists the workman lifts the first plate out and transfers it to a fifth pot, called the *Cold-pot*, filled with tallow, heated to a comparatively low temperature; as soon as the workman puts a sixth plate into No. 4, the boy removes the second to No. 5, and so on. The plates are left in No. 5 until they are cold enough to be handled. As they were placed vertically in the several baths, a *list* or *selvage* of tin adheres to the lower edges. To remove this, the plates are now, lastly, dipped in the so-called *List-pot*, a cast iron vessel, which contains only a small quantity of melted tin, sufficient to cover the bottom to the depth of a quarter of an inch; in this bath, which is kept at a rather high temperature, the plates are left until the list or wire of tin is melted, when the plate is taken out by the boy, and the list detached by a smart blow with a stick. The plates are now finally cleansed from grease by rubbing with dry bran, and then sorted according to quailty and size, and packed up in boxes. There are now some twenty different qualities in common use, distinguished by certain marks attached to the boxes; the standard for quotation being what is technically called "Common, No. 1," viz., 225 plates, 13¾ by 10 inches, weighing exactly one cwt. in a box.—*The Ironmonger.* [It is more than doubtful that any *alloy* whatever is found within the tin coating and the iron of the plate. Although the tendency to combine chemically is sufficient to induce the adhesion of the two metals, the great disparity of their fusing temparatures prevents the production of an alloy in any sensible proportion during the short period of immersion in the tin bath. The *not rusting* of the bright iron plates in *pure water* has nothing to do with their previous mode of preparation, as above apparently inferred. *Air and water* must both be present to cause any iron to oxidate at common temperature.—*Ed.*]

Steel Toys and Lancashire Tools.—The large variety of articles comprehended under the term "steel toys," are the very reverse of toys, and are often not made of steel at all. Heavy steel toys have been designated as "tools or articles of an implement nature used in domestic economy." To enumerate all the "toys" of this class would be to transcribe a large list of miscellaneous, cheap, and useful wares, from a joiner's hammer to a shoemaker's tack. The list includes nearly 600 articles. The pincers of the last-named workman, and the edged nippers commonly in use for breaking up loaf-sugar, are both of them well-known specimens of the extensive manufacture now adverted to. But they exhibit in the jointing a striking contrast with that close fitting which is so much admired in the Lancashire tools which operate on the same principle. The head-quarters of the Lancashire tool trade in Warrington, where every one of the numerous articles sold under the name of "tools," in the common meaning of the term, is produced in a style of perfection probably not to be surpassed in the world. The plyers in general use for cutting wire are a conspicuous illustration of the high excellency of theLancashire tool—an excellency which it is doubtful if even Birmingham has yet reached. The appropriate symmetry of the shape, the exquisite fitting and working of the joint, the regularity of the filling of the whole, the accurate meeting of the edges, and the admirable tempering, render this tool a curiosity in the estimation of those who can conceive how large a degree of accuracy of hand must have been requisite for its production. Many of these productions are made of iron and case hardened; and these as well as those wrought out of steel, are stripped with a smooth file, and then finished in a peculiar style of blackness, except just at the cutting part, which is ground and polished. Heavy steel toys, however, instead of being formed with such admirable symmetry, and exhibiting such rare workmanship as Lancashire tools, rather appear like cheap imitations of the "tools" —a description of article with which they may be directly compared. Instead, too, of being got up black, as is the case with the Lancashire articles, these Birmingham goods are filed bright and slightly burnished. Birmingham has the largest share of the heavy toy trade; but there are extensive manufacturers in Sheffield and Wolverhampton. Fine-edged tools are chiefly and best made in Sheffield. The trade in heavy toys increases yearly in importance, because it consists of articles which are greatly in demand in new countries, and new markets are opening by every new colonising enterprise of the Anglo Saxon race. The manufacture includes a good deal of wood-work for handles as well as iron and steel. Although many axes are made for the American market after special patterns and with national mottoes, no handles are ever sent out, as the backwoodsmen have better wood for their purpose at command. Our axe handles are stiff; a backwoodsman must have a flexible handle or haft; and the Americans are adapting themselves to the demand of the market. Not long ago an importation of German tools startled the manufacturers of this country by the extremely low price at which they were offered for sale. But when the goods were tested it was found that the plyers gaped at the mouth—they refused to cut, hold, or grip; the chisels became blunted; the hand vices refused to pinch or hold. On examination they were found to have been formed of malleable cast-iron, hardened after undergoing a rough finish by grinding or smoothing; not by means of the tedious process of case hardening—that is, by being enclosed in a close iron case filled with charred animal substance, such as leather, horns, hoofs, or burnt bone dust, and subjected for some hours to a red heat, and when in this heated state plunged into oil or water—but simply by heating them over an open charcoal fire, and when at a dull red heat sprinkling on or rubbing over them the substance known as prussiate of potash. When cooling the articles in water, the superficial character of this hardening allowed the interior of the metal to retain its malleable properties; but whenever pressure or abrasion was applied, the nature of the material of which these goods was formed was disclosed. In no manufacture has the annealing process been more taken advantage of than in that of saddlers' ironmongery. Stirrups, bits, the fanciful spurs exported to South America, buckles, &c., are made of cast malleable iron, a prodigious amount of labour, formerly expended by the blacksmith in beating out wrought iron, being thereby saved. Among other articles to which the process is applied as snuffers, and the but-plates, the guards, and other portions of metal used in the gun trade. The heavy toy trade is not free from fits of prosperity and depression, resulting from the freaks of fashion to which the light toy trade is especially exposed. When flounces were in fashion, a great demand sprang up in Birmingham for pinking irons, which previously had only been used for ornamenting the hems of shrouds; and a workman has been known to earn about 3*l.* a week for two years in making them. The very effective tools used by burglars and housebreakers are known to be made by certain journeymen in the heavy toy trade. Hand-cuffs, leg-irons, and similar restraining instruments are made in the usual course of business, as steel toys. Occasionally, London and Liverpool houses in the Brazilian or Cuban trade have ordered suits of chains, intended for the use of slave ships. These are cheap, coarse, painted black, and wear a frightfully repulsive aspect. Among the orders on the books of one Birmingham house in the heavy toy trade, some time ago, were several dozen pair of hand-cuffs for ladies,—Birmingham has long been noted for the superiority of its workmen in the production of an endless variety of steel trinkets, known as light steel toys, for which this country was formerly indebted to Milan, Berlin, and other foreign marts. But Birmingham was scarcely known for its hardwares when, in the reign of Henry VII., an Act was passed, interdicting the introduction into this country by "merchant strangers," of the "small wares," for the manufacture of which Birmingham is now in so high repute. At one time, as many as 5,000 people in Birmingham were employed in the manufacture of shoe and knee buckles, and it was then the staple trade of the town. The time was, when almost every shod foot in the kingdom was dependent on the buckle for its garniture. The celebrated works of the Soho, which have been so widely celebrated for the coinage of British and other money, and still more so for the improvement —almost the invention—of the steam-engine, originated with the manufacture of those small steel articles of which buckles constituted so important a part. "Boulton and Watt (says Hunt) must ever be mentioned together in connection with the Soho Works; but it is hardly hyperbolical to say, that the patent steam-engines of the latter have not been more extensively known in this country of late years, than were at one time the patent shoe-latchets of the former." The entire trade in light steel toys is extremely fluctuating to this day. Its condition depends very much on inventive taste, in which we are manifestly inferior to the French.—*The Ironmonger.*

THE SILICATED CARBON FILTERS.—Water is one of the most important necessaries of human life, no less than 75 per cent. of the human body consists of this element. It is then of the utmost importance, in a sanitary point of view, to use only pure water. But unfortunately the water supplied to towns, as well as that generally obtained in country places, is largely contaminated with organic impurities. A vast amount of disease arises from the use of impure water. This was strikingly illustrated in 1854, in the parish of St James', London, during the prevalence of cholera in that district. The very large amount of mortality which occurred in the immediate neighbourhood of Broad Street was clearly traced to the use of the water obtained from a pump in that street. If we resort to the use of rain water, we do not avoid the danger, for in its descent through the atmosphere of towns, the otherwise pure water becomes largely impregnated with impurities, so that it becomes quickly charged with animal life, and eminently unwholesome for use. The silicated carbon filter offers at once a ready and inexpensive means of obtaining at all times a supply of pure water. The invention is that of Mr Dahlke, a German chemist, and consists of an intimate combination of carbon in its most effective form with silica in a highly comminuted state, as they exist in the celebrated Torbane Hill mineral. The compound is formed into blocks of any required size, through which the water percolates, and in so doing becomes purified. This purification is not merely mechanical, like that which is produced by the ordinary water-filters, but it is also chemical, for we have it in the evidence of undoubted authorities that water containing lead in solution is entirely deprived of any traces of that deleterious body when passed through this filter. The advantage of the new filter in this respect cannot well be overrated. Upon the various organic impurities contained in water the filter also acts with an equally effective purifying power. Thus, we are told, that the nitrogeneous products, as ammonia, which is a sure indication of organic matter in a state of poisonous decomposition, becomes changed and rendered harmless by the oxidation which the filter induces. The quantity of organic matter with which the water supplied by town pumps is impregnated has been estimated to range from 1·5 grains per gallon to 8·8; the common salt from 2·7 to 25; the sulphate of lime from 2 to 29; the alkaline nitrates from 2·1 to 24·6; and the combined ammonia from 0·5 to 2 grains per gallon. The blocks of silicated carbon are manufactured at the works of the Silicated Carbon Filter Company, and they are made to suit filters of all kinds. Thus they are made so portable that one may be carried in the pocket, so that one may drink pure water from the nearest pond or brook. To the pedestrian tourist, the working man, the soldier, and indeed all who travel away from home, this is a boon of inestimable value. These filters are also adapted for cisterns, household and cottage use, as well as for water bottles standing upon the table. They have also been adapted in the public drinking fountains. We hope that philanthropic individuals will exert themselves to get them largely introduced into the houses of the poorer classes. It should indeed be made a part of the health officer's duty to see that the service pipes of each district were supplied with these filters.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS.

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

1st *November*, 1861.

2748. Andrew Smith, Mauchline, Ayrshire—An improved combined book marker and paper cutter.

2749. Michael Henry, Fleet Street—Improvements in steam engines and boilers. —(Communication from Henry Giffard, Boulevart Saint Martin, Paris.)

2750. William B. Smith, Camborne, and William Bennett, Tucking Mill, Cornwall —Preventing the injurious effects occasioned by smoke, sulphur, and the deleterious gases which escape from stacks, chimneys, calcining houses, chemical and other furnaces.

2nd *November*, 1861.

2751. William Worsley, Hovingham, Yorkshire—A self-acting railway signal.

2752. James S. Brooks, Mare Street, Hackney—A back or chest protecting brace or braces.

2753. Alfred F. Yarrow, Arundel Square, Barnsbury, and James B. Hilditch, Barnsbury Villas—Improvements in machinery used when ploughing, tilling, or cultivating land by steam-power.

2754. John C. Wilson, Bucklersbury—Improvements in machinery or apparatus for the manufacture of sugar.

2755. Thomas Walker, Robert Terrace, King's Road, Chelsea—Certain improvements in the construction of cables or chains for telegraphic and other purposes, and for machinery connected therewith.

2756. James Wright, Bridge Street, Blackfriars—Improvements in the method of and apparatus for separating foreign matters from the droppings from carding machines, and for returning the residue thereunto.—(Communication from Messieurs Fitton and Fullerton, Cavendish, Windsor, Vermont, U.S.)

2757. John French, Manchester Road, Bradford, Yorkshire—Improvements in machinery or apparatus for doubling or twisting yarns of worsted or other fibrous substances.

2758. Benjamin Brown and Richard Hacking, Bury, Lancashire—Improvements in machinery for preparing cotton to be spun, known as openers, scutchers, and carding engines.

2759. Samuel Osborne, Bayswater—Improvements in hooped skirts.

2760. Thomas Lockie, Glasgow, Lanarkshire—Improvements in the manufacture of wrought-iron wheels.

2761. George Evans, Cloucester Terrace, Portman Square—Improvements in treating peat to render it useful as fuel, and for illuminating and metallurgical purposes.

2762. Samuel W. Worssam, King's Road, Chelsea—Improvements in machinery for cutting wood.

2763. Thomas Spencer, Prescot, and Thomas Robinson, St. Helen's, Lancashire—Improvements in machinery or apparatus for making pipes and other articles of earthenware, and in the form of pipes, for gas, sewage, and other purposes.—(Communication from Alfred Delafal, Paris.)

4th November, 1861.

2764. Joseph Bowden, Hulme Street Works, Salford, Lancashire—Certain improvements in dyeing and in apparatus employed in dyeing.

2765. John C. Anderson, Portland Place, Summer Road, Croydon—Practice bowling in the manly English game of cricket.

2766. John Arches, Birmingham, Warwickshire—Improvements in certain kinds of weighing machines, balances, and scale beams.

2767. John Stewart, Glasgow, Lanarkshire—Improvements in the manufacture of cards for jacquard weaving.—(Communication from Louis J. Fillion, Grougès, Aisne, France.)

2768. George Horton, Sheffield, Yorkshire—An improved construction of skate.

2769. William Clark, Chancery Lane—Improvements in water meters.—(Communication from Messrs Frank G. Johnson, Brooklyn, King's County, William T. B. Milliken, Morrisania, Westchester County, and Edmund Joues, New York, U.S.)

2770. William T. Weston, Trafalgar Square—An improved spring and fastening applicable to various useful purposes.

2771. John Ashley, Grosvenor Place, Bath—Improvements in apparatus for attaching horses to carriages.

5th November, 1861.

2772. Robert Wilson, Patricroft, Manchester—Certain improvements in steam hammers, and in valves applicable to the same and to other steam engines.

2773. James Livesey, Manchester—Improvements in apparatus for communicating from one part of a railway train to another, and for coupling pipes.

2774. Edgar Brooks, Birmingham, Warwickshire—An improvement or improvements in the manufacture of bayonets.

2775. William Hall, Calais, France—Improvements in the production of curved and other forms in articles of lace.

2776. Charles F. Hayes, Enfield—Improvements in means or apparatus for generating steam.

2777. Richard Fethney, Manchester, Lancashire—Improvements in machinery or apparatus for preparing spinning or doubling cotton, silk, and other fibrous materials, parts of which improvements are applicable for winding and other purposes.

2778. Richard A. Brooman, Fleet Street—Improvements in steam generators and in furnaces for the same.—(Communication from Alexaudre Friedmanu and Frederic E. de Erlanger, Paris.)

2779. Edward Bowra, Upper Norwood, Surrey—Improvements in the manufacture of elastic fabrics.

2780. John B. Love, Philadelphia, Pennsylvania, U.S.—Improvements in the mode of combining together and securing to the sides of navigable vessels and water batteries armour plates of iron or steel.

2781. John P. Bourquin, Newman Street, Oxford Street—Improvements in ornamenting the covers of photographic albums, books, writing cases, and other like articles.

2782. Samuel Griffiths, Wolverhampton, Staffordshire—Certain improvements in the manufacture of iron.

2783. Henry Orth, Wisscmbourg, France—An improved soap.

2784. George T. Bousefield, Loughborough Park, Brixton, Surrey—Improvements in electro-plating or depositing metals.—(Communication from Jabez E. Walcott, Boston, Massachusetts, U.S.)

6th November, 1861.

2785. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in fire-arms and ordnance.—(Communication from Benjamin F. Joslyu, Stonington, Connecticut, U.S.)

2786. Herman D. Bradt, Boston, Massachusetts, U.S.—Certain new and useful improvements in machinery for lasting and pegging shoes.—(Communication from John Taggart, Roxbury, Massachusetts, U.S.)

2787. Alexander Prince, Trafalgar Square, Charing Cross—Improvements in furnaces for reducing zinc-ores.—(Communication from Adolphe Charlier, Stolberg, near Aix-la-Chapelle, Prussia.)

2788. William Ramsell, Deptford, Kent—Improvements in the construction of boats, barges, buoys, and other like structures of metal, and in machinery employed therein.

2789. Frederick H. Schröder, Hampstead—Improvements in evaporating and in machinery employed therein.

2790. Frederick G. Stuber, St. James's Road, Brixton, Surrey—An improved hygrometer for measuring the humidity of the atmosphere, dampness of beds, garments, and for other purposes.

7th November, 1861.

2791. Simou Cockett, Blackburn, Lancashire—Improvements in cop tubes.

2792. John Wahnsley, New Accringtou, Lancashire—Improvements in looms for weaving.

2793. William E. Gedge, Wellington Street, Strand—Increasing the production of wool.—(Communication from Casimir Maistre, Villeneuvette (Hérault), France.)

2794. Alexander W. Williamson, Gower Street—Improvements in the construction of boilers.

2795. John R. Wigham, Capel Street, Dublin, Ireland—Improvements in apparatus for the manufacture of gas, parts of which are also applicable for cooking purposes.

2796. Samuel Lepard, Cloak Lane—Improvements in apparatus for heating and warming conservatories, greenhouses, ferneries, orchard houses, or other buildings and rooms.

2797. Theodore Schwartz, New York, U.S.—A new air engine or air motor (termed recuperative).

2798. Henry G. Gibson, Mark Lane—Improvements in apparatuses for drying hops, malt, grain, and other vegetable substances, part of which is applicable as a fan or blower.—(Communication from Joseph Perrigault, Rennes, France.)

2799. John Hancock, Nottinghamshire—Improvements in the manufacture of looped fabrics, and in machinery to be employed therein.

2800. William A. Shepard, Pall Mall—Improvements in preparing and treating gutta percha and india rubber.

2801. John Barrow, West Gorton, near Manchester—Improvements in the manufacture of benzole, naphtha, naphthaline, aniline, and carbolic acid.

8th November, 1861.

2802. Thomas C. Darby, Little Waltham, Essex—Hoeing growing crops and ploughing.

2803. Benjamin Dobson and James Clough, Bolton-le-Moors, Lancashire—Certain improvements in machinery for combing, preparing, and spinning cotton and other fibrous substances.

2804. Henry Montucci, Rue du Sentier, Paris—Goffering or embossing stuffs in high relief.

2805. Charles W. Siemens, Great George Street, Westminster—The construction of a certain destructive weapon to be used in naval warfare.

2806. Joseph Tyler, Pratt Street, Camden Town—Improvements in the manufacture of clarionets.

2807. William Clark, Chancery Lane—Improvements in railway signal apparatus for the prevention of the collision of trains.—(Communication from Messrs Auguste L. Vérité, and Julien S. Bazin, Boulevart St. Martin, Paris.)

2808. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in the treatment of carpets.—(Communication from Jean A. E. Polonceau, Paris.)

2809. John Byrne, Whitehouse, Antrim—Improvements in machinery or apparatus for scutching and refining flax, hemp, jute, and other fibrous substances.

2810. Aristide B. Berard, Avenue Montaigne, Paris—Improvements in separating metals from their ores.

9th November, 1861.

2811. David Cowan, Hungerford Street, Strand—An improved mode of constructing pneumatic subaqueous tubes for passenger or goods traffic, and certain machinery for the manufacture of the same.

2812. Mark Morgan, Wellington Street, Strand—An improved gaiter or covering for the leg.

2813. George Simpson, Glasgow, Lanarkshire—Improvements in boring apparatus such as is used for mining purposes.

2814. Robert M'Nair, Glasgow, Lanarkshire—Improvements in casings for stitching machines, and in adapting the same for writing.

2815. Francois H. M. C. D. C. F. de Lacombe, Paris—Improvements in generating hydrogen gas for illuminating or other purposes, and in apparatus used thereby.

2816. Sam Hague, Nottingham—Improvements in the manufacture of hoes, adzes, or other articles.

2817. John Fisher, Carrington, near Nottingham—Improvements in apparatus for indicating or regulating the passing of railway trains.

2818. Samuel W. Campain, Deeping St. Nicholas, Lincolnshire—Improvements in apparatus for stacking straw and other agricultural produce.

2819. Richard A. Brooman, Fleet Street—Improvements in obtaining alkaline phosphates.—(Communication from Edouard Aubertin, Paris.)

2820. Richard A. Brooman, Fleet Street—An improved spinning toy.—(Communication from Gustave X. Tantain and Louis A. Coquet, Paris.)

2821. Edward Loysell, Cannon Street—Improvements in match-boxes or cases.

2822. William E. Newton, Chancery Lane—Improved apparatus for manufacturing and containing gaseous liquids.—(Communication from Pierre P. H. Couillard, Rue St. Sébastien, Paris.)

2823. Archibald Turucr, Leicester—Improvements in knitting machinery.

2824. William Clark, Chancery Lane—Improvements in portable and other filters.—(Communication from Jules P. A. Hayard and Jean B. Bourgoise, Boulevart St. Martin, Paris.

2825. Francis O'Reilly, Shaw Street, Dublin, Ireland—An apparatus to enable tailors to work at an ordinary table without sitting.

11th November, 1861.

2826. William Tongue, Cryssell Road, Brixton, Surrey—Improvements in processes for treating, preparing, and combing certain fibrous materials, and in the machinery or apparatus employed for these purposes.

2827. David Y. Stewart, Glasgow, Lanarkshire—Improvement in the manufacture of cast-iron pipes and similar articles.

2828. George Leslie, Mall—Improvements in pens and writing instruments.

2829. William Clark, Chancery Lane—Improvements in safety lamps.—(Communication from Mr Pierre Dernoucourt, Boulevart St. Martin, Paris.)

2830. James J. Shedlock, Weirdale Villas, Earls Court, Kensington.—Improvements in gas meters.

2831. George F. Wilson and George Payne, Battersea, Surrey—Improvements in treating fatty and oily matters.

2832. Alexander Shannon, New York, U.S.—An improved method of accelerating projectiles.

2833. Chauncy O. Crosby, Bridge Street, Blackfriars—Improvements in the manufacture of pointed trimming, and in the machinery for manufacturing pointed trimming.

12*th November*, 1861.

2834. William J. Hay, Southsea, Hants—Improvements in protecting iron and wooden ships, caissons, dams, and other wooden or iron structures from decay and from fouling by vegetable and animal matters, and in preparing the materials employed therein.

2835. Robert Bellis, Chester—An improved method of laying wood floors.

2836. John Davidson, Leek, Staffordshire—Improvements in apparatus for communicating between the passengers and the guard and engine driver of a railway train.

2837. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in bleaching cotton and other textile fabrics or materials, and in the apparatus employed in such process.—(Communication from Edouard Turpault, Paris.)

2838. William Cooke, Spring Gardens, Saint Martin's-in-the-Fields—Improvements relating to carriages and vehicles, and the ventilation thereof, the same being also applicable to other purposes.

2839. Alfred V. Newton, Chancery Lane—Improvements in the construction of dinner plates.—(Communication from Daniel H. Shirley, Boston, U.S.)

2840. William E. Newton, Chancery Lane—Improvements in self feeding inkstands.—(Communication from Charles Close, New York, U.S.)

2841. William E. Newton, Chancery Lane—Improvements in skates.—(Communication from Daniel H. Shirley, Boston, Massachusetts, U.S.)

2842. William Tongue, Chryssell Road, Brixton, Surrey—Improvements in the manufacture of printed yarns and in the application of certain fibrous materials to the manufacture of certain descriptions of yarns and threads.

2843. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in the construction of steam or other vapour and water or other liquid tight joints.—(Communication from Joseph Harrison, Philadelphia, U.S.)

2844. Louis F. Duval and Louis A. Beaudet, Boulevart St. Martin, Paris—A new process of tanning.

2845. Michael Henry, Fleet Street—An improvement in, and composition for treating iron and steel and articles manufactured thereof.—(Communication from Alphonse M. de la Mothe, Boulevart St. Martin, Paris.)

13*th November*, 1861.

2846. Thomas L. Holt, Brook House, Brentford—Making of paper from the cochlearia armoracia or horse radish.

2847. Thomas B. Collingwood and Abraham Butterworth, Rochdale, Lancashire—Improvements in throstle and doubling frames for spinning and doubling fibrous materials.

2848. John Hodgkinson and Daniel Greenhalgh, Bolton, Lancashire—Improvements in machinery or apparatus for preparing cotton, cotton waste, or other fibrous materials to be spun.

2849. William H. Hammersley, Leek, Staffordshire—Improvements in machinery or apparatus for stretching, glossing, and finishing silk.—(Communication from James Leigh, Brooklyn, America.)

2850. William Clark, Chancery Lane—The application of electricity in refining cast iron for the purpose of converting it into wrought iron or steel with or without the addition of other agents.—(Communication from Francois A. A. Dufournel, Boulevart St Martin, Paris.)

2851. Edward C. Kemp, Avon Place, Pershore Road, Birmingham, Warwickshire—Improvements in gas lamp glasses and other fittings.

2852. Sir William G. Armstrong, Newcastle-upon-Tyne—Improvements in the means of firing or igniting explosive projectiles.

2853. Louis Rolland, Quai Jemmapes, Paris—An improved spring door shutter with a moveable lever.

2854. Thomas Procter, Boston, Lincolnshire—Improvements in carriers or stackers, or apparatus for facilitating the stacking of straw, hay, or agricultural produce.

2855. William H. Balmain and John Kean, St. Helens, Lancashire—Improvements in the manufacture of flowers of sulphur and roll and other forms of sulphur.

2856. Joseph Vaughan, Birmingham, Warwickshire—An improvement or improvements in the manufacture of bayonets, and in apparatus or machinery to be employed therein.

2857. Charles E. Wilson, Monkwell Street—A new article of female wearing apparel to be worn on the leg.

2858. Isaac T. Townsend, Attleborough, Warwickshire—Improvements in harness to be used in the manufacture of all textile fabrics.

2859. Frederick Coney, Waterloo Road, Surrey—An improved stock for brooms.

2860. Richard A. Brooman, Fleet Street—Improvements in albums for containing photographic and other pictures.—(Communication from Auguste Marion, Paris.)

2861. Henry Bird, Liverpool, Lancashire—Improvements applicable to corks and other stoppers for bottles and other vessels containing poison, also to bottles and other vessels for containing poison.

2862. Alfred E. Carter, Kensington, and Thomas Hack—Improvements in screw cocks.

2863. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in the manufacture of soap.—(Communication from Campbell Morfit, New York, U.S.)

2864. John Leslie, Conduit Street, Hanover Square—Improvements in the manufacture of gas.

2865. Henry R. Fricker, Leman Street, Whitechapel, and John Manley, Fairmantle Street, Truro, Cornwall—Improvements in apparatus for facilitating the cleansing of sewers and other water courses or ways.

14*th November*, 1861.

2866. Alfred O. Lipsett, Manchester, Lancashire—Improvements in apparatus for heating or boiling fluids for domestic or other purposes.

2867. George Bridge, Bollington, near Macclesfield, Cheshire—Improvements in machinery or apparatus for preparing cotton and other fibrous materials to be spun.

2868. William Heap, Ashton-under-Lyne, Lancashire—An improved instrument for cutting pipes and bars of metal.

2869. Montague Wigzell, Strand, Topsham, Devonshire—Improvements in machinery or apparatus to be used in moulding and casting twisted nails, spiral fluted nails, bolts and screws for sheathing vessels, ship building, building, and other purposes.

2870. Robert Heath, St. George's Place, Hyde Park Corner—An improvement in umbrellas and parasols.

2871. Frederick R. Hughes, Borrowstounness, and Thomas Richardson, Newcastle-on-Tyne—Improvements in treating certain natural saline compounds, to fit them for agricultural use, and in order to obtain potash and other salts.

2872. George Hawksley, Three Mill Lane, Bromley-by-Bow—Improvements in apparatus for sounding alarums and actuating ventilators.

2873. William Leopard, Hurstpierpoint, Sussex—Improvements in railway break apparatus.

15*th November*, 1861.

2874. Charles H. Murchin, Manchester, Lancashire—Improvements in ventilators for railway and other carriages, and for other similar purposes.

2875. John Nixon, Cardiff, Glamorganshire—Improvements in apparatus for ventilating coal or other mines or other underground excavation.

2876. James Spratt, Camden Road Villas, Camden Town—Improvements in the preparation of food for hogs, dogs, cats, and poultry, and in apparatus for the same.

2877. Edward Loomes, Whittlesey, Isle of Ely, Cambridge—Improved machinery for moulding bricks, tiles, and other like articles.

2878. William E. Newton, Chancery Lane—Improvements in steam engine governors.—(Communication from Wellington Lee, East Nineteenth Street, New York, U.S.)

2879. Louis A. Soupart, Brussels, Belgium—Improvements in the mode of preparing and subsequently tanning hides or skins.

2880. Werner Staufen, London Road, Southwark, Surrey—Improvements in the manufacture of brushes, and in preparing certain vegetable fibres for such and other uses.

16*th November*, 1861.

2881. James Grint, Harrison Street, Gray's Inn Road—Improvements in the mode or method of uniting and otherwise connecting surfaces of leather, wood, and other substances and the apparatus connected therewith for manufacturing the same.

2882. Joseph Booth, Thomas W. Chambers and James Chambers, Bury, Lancashire—Improvements in looms for weaving.

2883. Jonathan C. Goodall, Great College Street, Camden Town, and John Beale, East Greenwich—Improvements in machinery for folding envelopes.

2884. Matthew Gibson, Gallowgate, Newcastle-on-Tyne—Improvements in reaping and mowing machines.

2885. Eugène D' Estangue, Mont-de-Marsan, Landes, France—An instrument for drawing teeth without danger, as the extraction is made without any version, any pressure on the gum, or action whatever with the neighbouring teeth, and in a word the said instrument not resting upon any part of the mouth.

2886. David Stewart, Newcastle-on-Tyne, Northumberlandshire—Improvements in hydraulic cotton presses "worked by steam."

2887. Robert T. Worton, Newberry Place, Kentish Town—Improvements in pianofortes.

2888. Joseph Else and Thomas Godfrey, Mansfield, Nottinghamshire—An improved washing apparatus.

2889. William Naish, Wilton, Wiltshire—Improvements in "numnahs" or saddle cloths.

18*th November*, 1861.

2890. James M. Clements, Birmingham, Warwickshire—Improvements in the making or manufacturing of certain parts of garments for either sex, likewise in the manner of preparing the same for sale, as also an improved button to be attached to garments without sewing, and in the machines for creasing, folding, and performing the various kinds of stitching, sewing, and button hole working necessary in making parts of the same, and which said improved machines are also applicable for performing such kind of work generally.

2891. John Hawkins, Walsall, Staffordshire—Certain improvements in bits for riding and driving.

2892. William Cliff and Edwin Cliff, St. Quentin, de l'Aisne, France—Improvements in lace.

2893. Pierre André, Jean F. Pline-Faurie and Joseph P. Richard, Bordeaux, France—Machinery or apparatus for preparing or manufacturing fuel.

2894. Frederick C. Paetow, Manchester, Lancashire—Improvements in machinery or apparatus for raising and finishing fabrics.—(Communication from Fillman Esser, Burtscheid, Prussia.)

2895. Martin D. Rogers, Bow Lane Cottages, Saint Leonard's Road, Bromley—An improved chain cable stopper or controller.

2896. Richard A. Brooman, Fleet Street—Improvements in reaping machines.—(Communication from Cyrus H. M'Cormick, Chicago, U.S.)

2897. Charles M. Pouillet, Paris—An improved mode of constructing and fixing the rails of railways.

2898. Guillaume Prodon-Bonneton and Marthe G. Prodon, Thiers, Puy-de-Dome, France—Improvements in means or apparatus for rolling metals.

2899. Anthony J. Mundella and William Onion, Nottingham—Improvements in machinery or apparatus for the manufacture of looped fabrics.

2900. George Parry, Monmouth—Improvements in the manufacture of iron and steel.

19 *November*, 1861.

2901. Luke Smith and Matthew Smith, Heywood, Lancashire—Improvements in raising liquids, and in apparatus connected therewith, parts of which are applicable to improving the quality of fermented liquors.

2902. James Hemingway, Robert Town, Yorkshire—Improvements in machinery or apparatus to be used in the working "winning" or mining of coal, clay, shale, and other minerals or earthy matters.

2903. Theophilus Redwood, Montague Street, Russell Square—Improvements in the manufacture of starch and of a vegetable sizing powder.

2904. Jesse Lee, Church Gate, Leicestershire—Improvements in the construction of the wheels of traction engines, and in the mode of adaption to such said engines.

2905. John Taylor and Thomas H. Hepworth, Hyde, Cheshire—Improvements in equilibrium lubricators for steam cylinders, valve boxes, and other similar purposes.

2906. Simon Dédé, Rue Duvivier, Paris—A new process of discolouring, purifying, and improving varnish, oil, resin, gum, ether, wines, spirits, and other matters through the application of compressed air, which I call "The natural purifying decolorant."

2907. Benjamin D. Godfrey, Massachusetts, U.S.—An improved boot or shoe with a wooden shank part and a flexible fore part to the sole.

2908. Richard A. Brooman, Fleet Street—Improvements in breech-loading firearms.—(Communication from George White, New York, U.S.)

2909. Joseph Schloss, Cannon Street West—Improvements in pouches.

2910. Frederick L Stott and Mark Tomlinson, Rochdale, Lancashire—Improvements in the construction of vessels or apparatus for supplying lubricating matter to mechanism.

20*th November*, 1861.

2911. George Gwilliam, Savoy, Strand—Improvements in the manufacture or production of plate glass.

2912. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery or apparatus for cutting irregular and curvilinear forms in wood or other similar substances.—(Communication from Robert Marcher, New York, U.S.)

2913. Edward F. Smith and Thomas Swinnerton, Dudley, Worcestershire—An improvement or improvements in the manufacture of coke.

2914. Frederick Johnson, North Street, Westminster—Improvements in ground or earth screws.

2915. Joseph C. Croxford, Chapel Row, Exmouth Street, Clerkenwell—An improved mode of fastening doors and for other similar purposes.

2916. William P. Bayliss, Lloyd's, Madeley, Salop—Improvements applicable to buildings in order to facilitate the extinguishing of any conflagration which may happen therein.

2917. Francis Pals, Francis Terrace, Hackney Wick—Improvements in treating fatty and oily matters.

2918. Lynall Thomas, Union Street, Berkeley Square—Improvements in the mode of manufacturing and constructing wrought iron ordnance.

2919. Edward Peyton and William F. Batho, Birmingham, Warwickshire—Improvements in the moulds or chills employed in casting corner blocks, dovetail grooves, and other parts of metal bedsteads and other like articles in frames for carrying such moulds, and in tubes for the pillars of bedsteads and other like articles.

2920. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in the treatment of zinc ores, and in the apparatus employed therein, which improvements are also applicable to the manufacture of phosphorous—(Communication from Adrien Muller, Paris.)

21*st November*, 1861.

2921. Thomas Cowburn, Little Peter Street, Manchester—Improvements in apparatus for elevating boiling soap and for dividing the same into bars when congealed.

2922. Jamos Parkinson and Charles H. Minchin, Manchester, Lancashire—Improvements in the "Davy" or other safety lamps for miners.

2923. James H. Jeffs, Tottenham Court Road—Improvements in the manufacture of collars, shirt-fronts, cuffs, hats, bonnets, vests, and other articles of wearing apparel.

2924. George H. Polyblank, Piccadilly—Protecting and preserving photographic and other prints, water-colour drawings, and other works of art from injury and decay.

2025. John Gittoes, jun., Westbromwich, Staffordshire, and George Hinton, Oldbury, Worcestershire—Certain improvements in cupolas and furnaces for smelting or reducing ores and for the re-melting of pig iron.

2926. John Stubbs, Winsford, Cheshire—Improvements in apparatus for heating and evaporating brine in the manufacture of salt.

2927. Edward Brooks, Bradford, Yorkshire—Improvements in machinery for combing wool and other fibrous substances.

2988. William E. Newton, Chancery Lane—Improvements in rotary engines.—(Communication from John B. Root, New York, U.S.)

22*d November*, 1861.

2929. Hermann C Meyer, Ashford Street, Hoxton—Improvements in the means of stopping or retarding railway and other carriages.

2930. William Hirst, Halifax, Yorkshire—Improvements in the manufacture of paste, which is also applicable for sizing purposes.

2931. Alfred F. Yarrow, Arundel Square, Barnsbury—Improvements in locomotive steam carriages for common roads

2932. William Ambler, Keighley, Yorkshire—Improvements in the manufacture of loom pickers.

2933. Renil De Clerq and Emilie Cluzelles, Brussels, Belgium—A self-acting apparatus, called "Syphon or double water supplier," for raising water for any purposes, but especially adapted for forcing it at any pressure into boilers, and maintaining it there at a uniform level.

2934. George J. Farmer, Birmingham, Warwickshire—Improvements in machinery or apparatus for polishing shoe heels, toe plates, and other articles.

2935. Thomas W. Davenport and Samuel Cole, Balsall Heath, Worcestershire—Improvements in the manufacture of compositions to be employed for many purposes in connection with the useful arts and manufactures.

2936. Thomas W. Davenport and Samuel Cole, Balsall Heath, Worcestershire—Improvements in apparatus or machinery to be employed in the manufacture of ornamental and useful articles in papier maché.

2937. Charles Bartholomew, Broxholme Wheatley, near Doncaster, and John Heptinstall, Masbrough, Rotherham—Improvements in making circular blooms, such as are used in the manufacture of tyres and for other purposes.

2938. Edward Peyton and William F. Batho, Birmingham, Warwickshire—Improvements in laths for supporting bedding and cushions in bedsteads, couches, sofas, and seats.

2939. William Evans, Commercial Road East—Improvements in obtaining motive power.

2940. Michael Henry, Fleet Street—Improved means of rendering steam tight the opening for tho passage of the piston rod through the cylinder cover in steam engines, which means are applicable also to other parts of steam engines, and parts of other engines, machines, and apparatus for the rendering thereof steam tight and fluid tight.—(Communication from Francisque Million, Boulevart Saint Martin, Paris.)

23*d November*, 1861.

2941. Stephen Sansum, Birmingham, Warwickshire—An improvements or improvements in penholders.

2942. Marc A. F. Mennons, Ruo de l'Echiquior, Paris—An improved apparatus for the multiplication of motive power.—(Communication from Eugene C. M. Bounier, Ile Bourbon, Indian Sea).

2943. Charles H. J. W. M. Liebmann, Huddersfield, Yorkshire—Improvements in textile and felted fabrics.

2944. John Weems, Johnstone, Renfrewshire—Improvements in the manufacture of metallic tubes, and in coating or plating metals.

2945. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in toothed wheels, and in the apparatus used in their manufacture.—(Communication from Jean B. Buissart and Therse L. Levesque, Paris.)

2946. Richard A. Brooman, Fleet Street—An improved cup or vessel for administering liquids.—(Communication from Charles Halphen, Paris.)

2947. James Pitkin, Clerkenwell—Improvements in aneroid barometers.

2948. William Bary, Abinger Road, Lower Road, Deptford, Kent—An improved locomotive apparatus, particularly adapted to agricultural purposes.

2949. Eugene A. Rouviere, aine, Rue de Malte, Paris—An improved pump.

2950. Fedor De Wylde, Great College Street, Camden Town—Improvements in paper-making machinery.—(Communication from Louis Dupont, Nancy, France.

25*th November*, 1861.

2951. Vaughan Pendred, jun., Bully Curron, Kilkenny, Ireland—Improvements in surface condensers.

2952. Jean B. Hulard and Louis G. Poupel, Paris—An improved procoss for hardening stones and plaster of Paris, and making them impervious to water

2953. John Macintosh, North Bank, Regent's Park—Improvements in obtaining and applying motive power, and in apparatus connected therewith.

2954 George Lowry, Salford, Lancashire—Certain improvements in machinery for carding and hackling flax, tow, and other fibrous substances.

2955. James Ronald, Liverpool, Lancashire—Improvements applicable to machinery used for spinning hemp, flax, manilla wool, and like fibrous material, and for the manufacture of "topped-up," "formed," or "laid" thread, twine, cord, line, cable, and other cordage.

2956. John Goudie, Everard Street, Hartlepool, Durham—Improvements in reefing and stowing the sails of vessels

2957. William Burgess, Newgate Street—Improvements in reaping and mowing machines.

2958. James Willcox, Ludgate Hill—Improvements in sewing machines, and in apparatus connected therewith.—(Communication from Charles H. Willcox, New York, U.S.)

2959. John H Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery or apparatus for preparing oval picture frames.—(Communication from Robert Marcher, New York, U S.)

2960. John H. Johnson, Lincoln's Inn Fields and Buchanan Street, Glasgow, Lanarkshire—Improvements in machinery or apparatus for shelling and cleaning rice and other grain.—(Communication from Wellington Lee, New York, U.S.).

2961. Alfred V. Newton, Chancery Lane—An improved method of removing and preventing the formation of calcareous and saline deposits in stoam boilers. (Communication from Lewis Baird, Cambridge, Massachusetts, U.S)

TO READERS AND CORRESPONDENTS.

Owing to the pressure of other matter on our columns, we have been obliged to keep out this month the concluding portion of our report of the British Association.

MUZZLE SWIVELLING HYDRAULIC GUN MOUNTING.

Fig. 1 is a vertical section of the casemate and embrasure, in line of the crown arch, and square to the point, with elevation of the gun and mounting, etc.

Fig 2 A transverse section of casemate in rear of the hydraulic cylinder, in a plane parallel to the front face, with rear elevation of the gun and mounting, etc.

Fig. 3. A general plan of the gun mounting, etc., with horizontal section of the embrasure and casemate, in a plane or level of the centre of the embrasure.

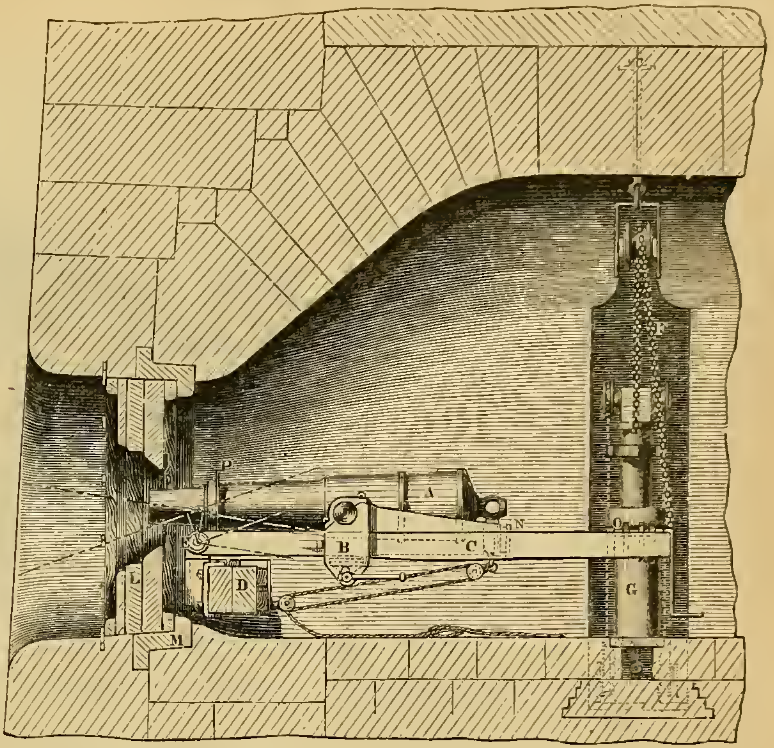
The same letters apply to all the figures.

A, the gun laid horizontally, its muzzle projecting through the aperture of the stopping plates, L, secured in the iron rabbate frame of embrasure, M.

B, the trunnion sliding carriage of wrought-iron, with the spring blocks beneath. C, the wrought-iron slide frame. D, the spring beam, to which the vertical pivot, E, admitting of movements in azimuth, is secured. P, the wrought-iron collar, fixed on the forward part of the gun to stop rifle bullets entering in the annular space round the gun's muzzle.

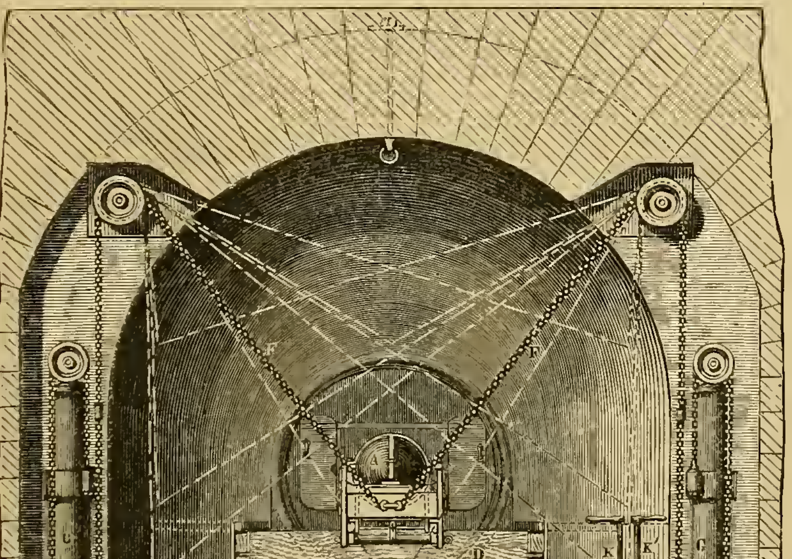
F F, the suspending and swaying chains at the rear of the slide frame. N, the buffer attached to the trunnion sliding carriage, which goes back with it, until it may strike the buffer, O, fixed at the rear end of the slide frame. G G, the hydraulic cylinders, etc.

Fig. 1.



We proceed, in continuation of the article in our December part, descriptive of Mr R. Mallet's method of mounting muzzle swivelling cannon, now to give his memoir on muzzle swivelling hydraulic gun mounting—a method by which, to all the advantages already attributed by him (and we must add also by so great an authority as General Sir Jno. F. Burgoyne, Inspec -Gen. of Fortifications) to muzzle swivelling alone, he superadds, the abolition of manual labour in working guns, or to a great degree supersedes it, and confers an amount of power and mastery over the movements of even the most ponderous ordnance, thus concentrated in the hands of the single man who aims, that we cannot but think, must, when adequately carried into practical trial, be found enormously to exalt the effects of our artillery, and most especially for shore batteries. A steam ship moving at the rate of twelve miles an hour across the face of a shore battery, at say 600 yards mean range, does not afford a time of more than four or five minutes during which she remains within effective distance—of this small fraction of duration, how much is, under the present system of training guns by hand, wasted and lost, in lumbering efforts of brute strength to train and work the gun, the aim being after all, less efficiently or exactly attained than by the prompt and precise means of mechanical power. To us, an insular nation, to whom coast defence is the primary military consideration—a people of iron and coal and steam—deficient or straitened in nothing, but in the supply of men for military service, as compared to our probable enemies, such a method of wielding our heavy artillery ought to commend itself with peculiar force and importance.

Fig 2

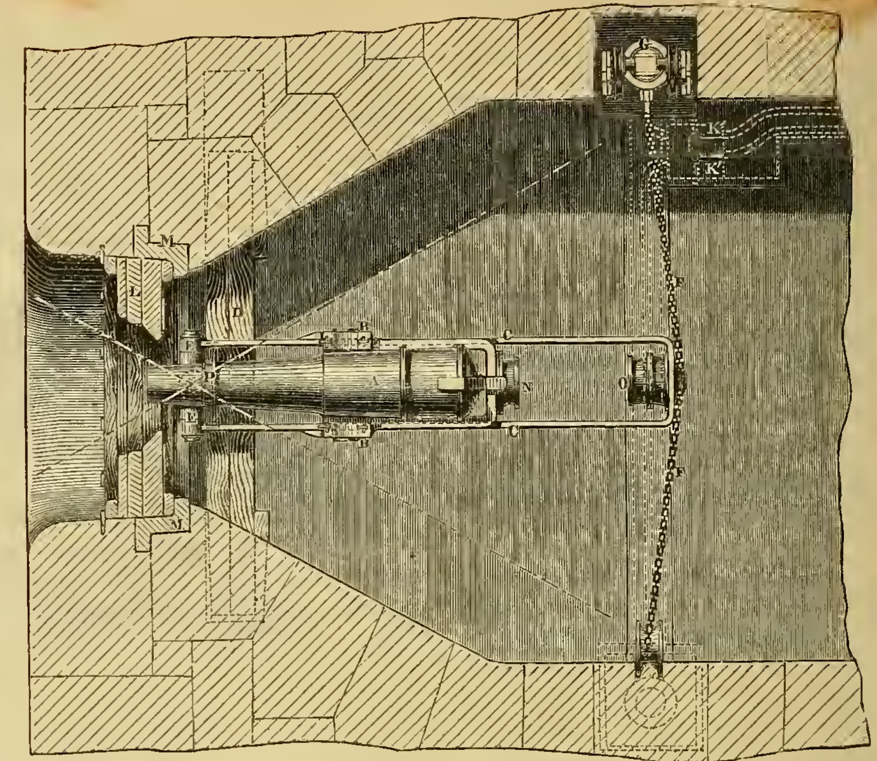


Mr Mallet has placed at our disposal also the official report made by the Ordnance Select Committee, by command of the Minister of War, upon this and the preceding documents and designs. We are unable to devote space to it in the present part, but purpose returning to the subject on an early occasion, giving that report, with some remarks by Mr Mallet, and closing with some of our own.

In the accompanying engravings, Nos. 1 and 2, a sixty-eight pounder is shown mounted upon a new method, and placed in a circular or other embrasure, stopped by alternate plates of iron and wood, leaving only a small, central, circular aperture, rather larger than the muzzle of the gun.

The gun swivels in all directions about a centre close to its own muzzle, i.e., it is pivoted both horizontally and vertically at the muzzle, so as, in common with other designs of the author's for gun mounting already presented (see *Practical Mechanic's Journal* for December, 1861) to preserve the great characteristic advantages of limiting the aperture necessary in the throat of the embrasure, to the smallest possible circular or elliptic opening concentric with the bore of the gun, or nearly so. The additional peculiarity of the present design is that the gun and its mounting are manœuvred in every direction without manual labour, by the application of hydraulic power in the manner originally invented and projected to its fullest details, and to all the uses to which it has been subsequently applied by the late Mr Joseph Bramah, but since brought into use for a great variety of hoisting and other purposes, by Messrs Armstrong of Newcastle-on-Tyne.

Fig. 3.



The gun is placed by its trunnions upon a wrought-iron carriage, which is free to slide back or forwards upon the side cheeks of a wrought-iron traverse frame. This traverse frame is pivoted close under the muzzle of the gun (when run forward) so as to be free to move either in vertical or horizontal arcs, or in both, round the centre. The one extremity of the traverse frame is held suspended by two chains, which pass from it right and left, to the sides and top part of the casemate, and are thence brought down over sheaves, and connected each with an hydraulic cylinder placed in a recess in the walls, so as to be out of reach of shot, etc. A supply of water at an adequate pressure is provided for these cylinders by the usual method of "an accumulator," with a pump worked by hand, or by a small high-pressure engine. All these are placed under ground, and in rear of the battery, so as to be quite secure. The admission and emission of water, and hence the movements of these cylinders, and of the suspending chains, are under the control of a single man, by means of two small valve handles situated at the right in rear of the gun.

If the gun be supposed laid, horizontal and square to the face of the battery, as shown in the engravings, then, if water be *admitted into both* cylinders simultaneously, both chains will be pulled equally, and the gun *breech* will be raised, or the *gun depressed* for range. If water be *emitted from both* simultaneously, the gun will be *elevated* in both cases without altering its range in azimuth. If water be *admitted to the left* cylinder, and *emitted from the right*, the gun will be traversed so as to range towards the proper right obliquely. And *vice versa*, admitting water on the right cylinder, and emitting from the left, the gun will traverse to range towards the proper left. If both movements be combined, *any angular motion whatever* may be at once given to the gun, within a cone of movement embraced by 60° of horizontal angle, 10° of elevation, and 15° of depression above and below the horizontal line. The only operation necessary to effect these movements is the turning back or forwards one or both of the lever handles of the valves seen in rear and right of the gun; and as the power available is so ample, as to bring the heaviest gun, even if it were twenty tons in weight, absolutely under easy control, so the rate of angular *movement of the gun may be so rapid that a boat or ship in the most rapid motion may be kept covered, and the gun even discharged as it moves if necessary.*

The 68-pounder gun, when discharged, recoils through a distance of three and a-half feet (or more if deemed necessary) and the recoil is brought to rest and opposed as follows:—The sliding carriage of the gun beneath each trunnion embraces the side cheeks of the iron traverse frame by two large slots. The traverse frame, which is perfectly straight along the top edges, is a long wedge or inclined plane along its lower edges, from the part where the gun carriage rests when in position for firing, (or run forward), to the rear end of range of recoil. A very simple locking arrangement, which will be readily understood by inspection of the drawing, is provided beneath the trunnions, by which two plates of gun metal, supported by spring blocks of vulcanized india rubber, are forced into contact with the inclined planes at the under edges of the traverse frame. This is done by a quarter turn of a lever handle, like that of a common vice acting upon a cam or eccentric on each end of a shaft which passes across below the frame. The spring blocks being thus brought into contact with these inclined planes, and the gun fired; the effect of the recoil of three and a-half feet, is to compress the spring blocks by their running back along the inclined planes of the traverse frame. The velocity of recoil is thus checked and greatly retarded by this, in a very gradual and gentle manner, and is finally brought to rest, by the buffer of vulcanized Indian rubber, at the rear of the gun carriage, coming into contact with that placed at the rear of the traverse frame. Under ordinary circumstances, however, the recoil will not be sufficient to bring these quite into contact. The shock of recoil is further provided against by the mode by which the vertical pivot that secures the muzzle of the gun is fixed. The wrought-iron socket into which this drops is bolted to the forward side of a horizontal spring beam of hard and elastic timber (green heart or American oak, for example) the ends of which are inserted and secured by wedges into two square recesses, provided in the opposite cheeks of the embrasure, inside the iron plate stoppers. At the moment of discharge this beam springs an inch or two, and so relieves the first shock upon the remainder of the system. For greater resilience, this beam is shown as formed in two thicknesses, each of eighteen inches by nine inches thick. The spring beam is readily placed in position, or removed from it, by merely slacking the wood wedges in rear of it, and moving it on end. By the conjoint operation of these arrangements, it is considered that the recoil of a 68-pounder may be safely brought up within three and a-half feet.

When the gun has recoiled to that extent, there is open three to three and a-half feet clear, between the muzzle and the inner face of the iron sliding shutters, provided to close, at that moment, the circular embrasure aperture against musketry, etc. This space is deemed sufficient to enable the cartridge and shot to be placed in the gun, and the ramming home to be effected. The handle of the rammer is first thrust out through a small circular aperture left for the purpose in the centre of the sliding shutters, and returned through the same as the charge is being rammed home. The narrowness of the traverse frame gives the men at both sides of it very convenient access, and great power over the charge in ramming home.

An iron projecting collar placed upon the muzzle of the gun, with an aperture for the "dispart sight," protects the head, of the gunner who lays the gun, against rifle bullets, &c. A hanging iron step (something like that of a railway carriage) is placed at the rear end of the traverse frame, and upon it the gunner stands when taking his aim; he therefore moves with the gun and its mounting; his eye is never off the line of sight and the object; and his only duty is to give the word to the man stationed at the two valve handles, *elevate, depress, right, left, hold*, and the gun, with its gunner, are swung about in any direction, with an ease and rapidity of movement unknown in any present mode of gun motion. This step detaches itself when the rear of the gun slide may require to be depressed to the level of the ground. The fire may be given at the word *fire* from the man who aims, either by friction tube or percussion lock, or the man who aims may himself fire the gun.

The gun will remain back at the rear extremity of its range of recoil until the lever handle of the spring blocks, beneath the traverse frame, is unlocked by half a turn. The gun, when again loaded, may be run forward by its own weight, by elevating the rear end of the traverse frame, which would probably be found always the most convenient plan, even though it was about to be fired level, or at an elevation of some degrees; but it may also be readily drawn forward for the 3½ feet along the traverse frame, by means of the (1 and 2 sheave) blocks and tackle seen beneath the frame. The succeeding recoil overhauls these blocks again, ready for use after the next discharge.

As *the casemate is assumed to be shot proof* in virtue of the mode of stopping the embrasure, so it is not to be supposed that either of the suspending chains of the gun mounting can be cut by shot, or that a splinter might enter and break one of the chains. A ring bolt, however, provided in the crown of the arch of the casemate, may have a rope hung from it in the form of a sort of loose breeching, so that, in the improbable event of either chain being cut, the traverse frame and gun will be caught and prevented from dropping, or the rear end of the traverse frame falling to the ground. If chains be deemed liable to objection in the remote chance of being cut, hempen hawser laid ropes, or wire ropes, may be substituted for them. The rope tackles about ships' guns, often cut by shot, are not found objectionable.

The ring bolt above spoken of, also affords the means of mounting and dismounting the gun, by the aid of a pair of purchase blocks, and to which the hoisting power of one or both of the hydraulic cylinders may be temporarily applied.

It will be remarked that only about one half of the actual weight of the gun bears upon the suspending chains in rear, or has to be encountered in moving it by them.

The hydraulic cylinders are accidentally drawn of an unnecessary diameter for perfectly manœuvring a 68-pounder. At the usual working pressure for hydraulic cranes, two cylinders, of 5 or 6 inches diameter each, would be amply sufficient for working a gun even of greater weight. It is not essential to this design that the hydraulic cylinders should be placed as shown or vertically. They may be laid down horizontally in a recess beneath the floor of the casemate, or in various other ways or positions so as to be most readily come at, and best protected from shot and shell. The advantages, or some of them, claimed for this arrangement, are:—

1st, Heavy guns may be manœuvred perfectly with a much smaller number of men than usual. Five men would probably be enough efficiently to man and rapidly fire each gun of 68 lbs.

2d, The power of *rapidly swaying* the gun in every direction, of *instantly arresting its motion*, and the power of either *rapid change* of directions, or *fine and gradual adjustment* of aim, offer immense advantages to the rapidity, power, and concentration of fire from coast batteries upon shipping in rapid motion. The gun may be swung about with an angular velocity of 10 or 12 feet per second, or instantly limited to a movement as slow as the hand of a watch, merely by varying the velocity with which the water is admitted to and emitted from, the cylinders, i.e., by turning more or less the valve lever handles.

3d, The method of mounting is applicable to all kinds of guns, and for Naval service, as well as for inland batteries, and would be of greatest advantage with a "breech loader." As *time* is saved, as well as manual *labour*, in every operation of handling the gun, so the fire from it when thus mounted may be much *more rapid* than ordinary, *with equal or greater exactness* of aim.

4th, This method of mounting and handling guns by hydraulic power is susceptible of remarkable extensions. It is as easy and as simple to sway and direct *every gun in a large battery by one man*, and acting upon one pair of valve levers at a single point, as it is to lay any single gun, and there is not the slightest difficulty in arrangements such, that an officer stationed at and *aiming the centre gun of a whole range shall automatically direct and aim all the others*, and that the fire of the whole range of guns shall be necessarily, and at his pleasure, concentrated upon the same point at which he aims. The fire of the whole battery thus aimed and concentrated may be given simultaneously from all the guns of the range, the moment the aim is perfected; either by galvanic discharge, as now practised in proving guns at Woolwich, or by the men in each casemate firing their own gun, by word of command communicated (from the officer who aims the centre gun, along with all the rest) either by telegraphic dials or by speaking tubes extending through all the casemates from the centre one.

5th, The cost of this method of mounting heavy guns (without reference to what immediately precedes in paragraph 4), if largely adopted, would not exceed the common one, with dwarf traversing slides and platforms inclusive. The hydraulic machinery is of the very simplest character, and experience of its application now for years, and upon a vast scale (extending, in the case of the Victoria Docks, to over 4 miles of pipes conveying the hydraulic power), has shown that it is not liable to derangement.

6th, The whole of the casemate and ample space round the gun is by this method left free and unimpeded. There is nothing to trip up the men in the dark, nothing to injure them by splinters if struck, and the narrow traverse carriage presents the smallest possible "end on" mark for being struck. The small steam engine adopted to pump the water into the large cylinder with loaded piston, known by the name of the "Accumulator," whence it issues to the working cylinders, would be capable of having steam up and being at work in 10 minutes* after lighting the fire, during that time the supply of water already stored up in the Accumulator would work the guns. The engine would be deep under ground, and perfectly free from chance of injury. It should also be employed to drive an air fan, to drive a constant supply of fresh air through channels below the floors into every casemate, and so keep them clear of smoke. If deemed more desirable, the accumulator may be kept filled by manual labour, or by horse power, either working under cover. This mode of mounting appears to offer the means of handling and directing monster guns, such as the 13-inch Mersey Company's gun, with the same facility as a 32-pounder, and hence of making such guns in reality generally available. Their use at present is almost limited to a fixed range, determined upon beforehand, from the inevitable loss of time in traversing by any of the ordinary methods such ponderous masses.

It is, however, to be understood that the method of *gun mounting* here designed is *not inevitably* connected with the use of hydraulic power or any other mechanical first mover, as it is obvious that two common purchase tackles or crab windlasses, moved by manual labour, might take the place of the hydraulic cylinders in each casemate, and that various other arrangements of the chains and ropes (other than that here proposed as the best,) may be devised, so that motion in all directions may be given to the traverse frame (as by any form of hoisting and traversing overhead gearing), and some of these modifications would be best applicable to ships' guns.

The distinguishing features of the plan are—1st, The gun swivels in all directions about its own muzzle. 2d, Its mounting is *not* (as in all cases heretofore,) *supported from below, but is suspended from above.* 3d, It is capable of being moved in all directions, without manual labour. 4th, The recoil is wholly taken up and absorbed by elastic resistances. 5th, The gun may be fired while it is still moving, and following its aim, if a moving object (a ship or boat), as in shooting flying.

THE ANNEALING TEMPERATURES OF METALS, AND CRYSTALLIZATION PRODUCED BY VIBRATION.

II.

In our last part, and first of this paper, we treated of the relations between temperature and tension in shrunk-on rings or hoops, such as wheel tyres, built-up gun segments, etc., both prior to and after superposition, and pointed out the relation to these of the sudden change of passive strength produced in all metals susceptible of being hardened by rolling, hammering, etc., at the annealing point of temperature, subjoining some observations as to the *desiderata* still required to complete our knowledge for the applied metals, as to the precise annealing temperature for each, and indicating an experimental method for endeavouring to obtain such data. We now purpose to treat briefly, but, as we hope, with the clearness that the practical value of the subject demands, upon the second clause of our title,—The Crystallization of Metals produced by Vibration.

We used advisedly these words at the head of this article, although essentially untrue to nature and fact. They are the common "cant phrase," we may call it, by which ill-informed men have, for more than twenty years, cloaked their ignorance, when called upon to discuss or explain what has taken place, when metals have been broken or torn asunder; and by which coroners and juries have been mystified, in cases of loss of life and limb, by broken tyres and axles, by a certain class of men, delighting to call themselves "practical," as though it were not a fact that *the only truly practical man is he who is accurate and well informed in theoretical knowledge.*

In this special subject, ignorance, confused and inadequate notions of the molecular constitution of metals in general, and of the changes therein, real or supposed, which happen when they are submitted to strains, steady or variable, or to fracture, is, unhappily, not confined to any class of engineers. Almost every man in the profession who has opened his lips, or put pen to paper on the subject, has shown how unformed and inexact his notions have been.

That we may not make such a statement without corroborative proof, let us refer our readers to a very few. Not to attempt a history, let us look into a paper by Mr Charles Hood, read at the Institution of Civil Engineers in 1842 (Min. of Proc., vol. ii. p. 180). Passing by at the commencement of the paper, the confounding of the chemical differences that produce "red short" and "cold short" iron, with those of simple, molecular condition, the author proceeds: "The fracture of railway axles . . . arises from this molecular change in the structure of the iron," (i.e., passing from red short to cold short in use!) he means, probably, only the change from tough to brittle. "The principal causes which produce this change are percussion, heat, and magnetism." . . . "The rapidity of the change is proportional to the combined action of these several causes; and in some cases where all the three causes are in operation at once, the change is almost instantaneous." "When any vapour is present along with heat, as in furnace bars with steam passing through from beneath, the conversion is particularly rapid." When vibration and magnetism are both produced, the temperature being within the limit at which the bar loses its magnetic power, it crystallizes, but above this (i.e., above a *red heat*) it don't.

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* The American Steam Fire Engines get up steam even in less time.

"When a peculiar jar or vibration has been given to particular parts" crystallization occurs; but the "peculiar jar or vibration" in the axles of common road carriages "is a case of the opposite kind," for here "no molecular change takes place *when the axle is insulated from the effects of magnetism*" (the italics are original). "In railway axles, however, the case is again different; rapid rotation of the axle causes powerful magnetic action; the friction causes much heat, and added to the percussion produced by the *peculiar motion* of railway wheels, causes crystallization with extreme rapidity," the effect being "increased in locomotive engine axles by the magnetising power of the electricity generated by the effluent steam."

The crystallized structure he considers the *natural* condition of iron; "and it makes a constant effort to return from the artificial" (what this state is we are not told) "to the primal condition of the metal." . . . And the conclusion arrived at is, "that crystallization is not necessarily dependent on time for its development, but is determined by other circumstances, of which the principle is undoubtedly vibration; that heat, although it assists, is not essential to it; but that magnetism, whether induced by percussion or otherwise, is an essential accompaniment of the phenomena."

"Woe unto ye that darken counsel by words without knowledge." In all this solemn twaddle of misty notions, enunciated without any attempt at proof, there is literally not one sentence of the truth of nature. Yet it seems to have been listened to and "discussed!" by the members of the Institution then present, without dissent or contradiction; and the obligation the Institution was supposed to be under to the author was expressed by the chairman.

In the succeeding session of the Institution, the subject was recurred to by Mr York's paper on Solid and Hollow Axles (Proc. Ins. C. E., vol. ii. p. 89, part 2). To Mr York we must do the justice of saying that he shows some approach to clearness in his description of the strains and wrenching jars to which axles are subject; but his notions about vibration and crystallization are much on a par with his predecessors.

"In the process of manufacture," if an axle be made hollow, "the crystallization of the iron is avoided," i.e., the iron in a solid, round bar is crystallized, but that in a hollow one or thick tube it is not! etc., etc.; and in the discussion following we have such statements as these:—"Mr Taylor—The fact that the *fibre* of iron was *restored* (after having been made crystalline by heavy, cold hammering) was well understood." "Mr Gravatt believed that vibration, whether caused by the smith in working the iron, or by the use to which the bar was appropriated, was the reason of its fracture; and it was certain that a constant change was going on in all manufactured iron." The president "considered that the principal question was the effect of vibration upon the cohesive strength of the metal," and so on.

Again, in 1850, (vol. ix. Proc. Ins. C. E., p. 298,) we have the subject brought forward by Mr Thorneycroft, who "disclaims any pretence to scientific research into the chemical constitution of metals," but brings to it the "light of his experience of forty-eight years, as a workman, a manager, and an ironmaster." Oh, much-abused word, "experience," so commonly confounded in England with knowledge in the supposed "expert," as though on such a subject as this, without the light of science, it was other than as a landscape to the blind. How happily did Whately hit off the fallacy by his illustration, "A man may have had great experience of stables, and yet know nothing about horses."

However, here are some of Mr Thorneycroft's experiences: "Independently of the alterations of texture from the process of manufacturing, great changes are induced by certain actions on it cold; compression or impact upon the *end* of a bar of iron, will alter its texture from a fibrous to a granular character. This is exemplified in tools used by forgemen; first, 'the gag,' a short bar of iron, of about two inches diameter, employed for holding up the hammer helve during intervals of working. It is subjected to impact whenever the lower end is placed on the anvil, and the helve falls about an inch to rest upon it. However fibrous may be the iron originally, it soon becomes brittle, and falls to pieces, as if of cast-iron. The other tool is the 'puddling bar,' which is often struck on end, and soon gets brittle."

These *facts* need not be disputed; but, if being "compressed or struck on the end" be the efficient causes, alone and unconditioned, of iron "becoming brittle and falling to pieces," how is it (as Mr Thorneycroft's experience knows) that the helve, or head of the *hammer itself*, which is constantly and for years compressed and struck on end, does not become brittle and fall to pieces, likewise—and "a fortiori;"—How is it that the piston-rods of all steam engines, and those still more of all steam hammers, do not soon fall to pieces?

Let us turn to the evidence given in 1849 before the Commissioners on the application of iron in railway structures, when certainly the best engineering testimony that was to be had was produced; let it be consulted *passim*, or more briefly, at p. 269, Appendix to Report, and it will be found that, while the common sense of several of the engineers or iron founders, rejects or qualifies this nonsense about "vibration," still none of them have any clearly defined knowledge as to the molecular arrangement of the internal particles of metals, and none at all as to what changes in these are producible, by external mechanical forces applied to produce change of form—indeed, the only two men who render even something like a common sense statement of the *facts* as they occur in nature, are the late Mr Robert Stephenson and Mr Brunell.

Some of the evidence given is ludicrous in its inconsistency. Thus, the late Mr Charles May cites the beam of a steam engine as an instance of continued vibration *not* being capable of producing any effect in altering the internal condition of iron, and follows that by an instance of a cast-iron gun used in his works for breaking castings upon, and which at last dropped in two as if it had been cut, as an indication, to *the very contrary*. All is confusion upon this particular matter throughout the evidence given. It would be out of our power to quote further special examples, but must refer to the Report, Appendix from p. 264 to 283 inclusive.

Such was the state of knowledge of this subject ten short years ago; it seems to be no better now, nor advanced (or rather promulgated amongst engineers and mechanics in practice), for advanced it *is* more than it was then.

A very recent patent is that of Mr John Marshall, of Liverpool Road, Middlesex, "For preventing the fracture of metals from crystallization;" and his method, which he obviously mainly intends to apply to axles, consists "in coating, covering, or surrounding all metals, whether simple or compound, which, when in use, are in a state of motion, accompanied by *vibration*, from percussion or any other cause, with a coat or covering of simple or compound metal, or *other material of a softer nature* than that of the metal to be protected from crystallization," which coating may be again covered with any hard metal or substance necessary to resist friction, etc., on the exterior surface. "The protecting soft metal, or other coating, *protects or insulates the core from vibration*." "The *vibration* of percussion communicated to the outer casing is *prevented from passing to the principal metal or core* by the soft metal or other insulator between them."

We have quoted the words of the specification of this amazing patent, in which we find, in the year 1862, confusion of thought, and ignorance of natural laws, as related to its subject, even beyond those of 1842 and 1850 that we have referred to. It is not without reason, then, that we endeavour to set before our readers a few words of soundness on this matter.

Were we for a moment to suppose it to be the fact that crystallization is produced by vibration, how is vibration to be *insulated* by a soft metal, or by any substance whatever, unless the latter change its form to an extent equal to the whole amplitude of the pulse wave of the vibration? If it be not thus *deformed*, the wave of vibration must pass on, though possibly with an altered velocity of transit, into the core or internal metal; and, if it *be* thus deformed, we take it, the core of soft metal and its covering, must soon part company. Suppose we take an extreme case. A steel axle, covered with a jacket of small thickness of india rubber (thus adding in the property of elasticity, of which Mr Marshall says nothing), and outside this a closely fitting tube of steel again. If we give a blow to the outer casing, all such portion of the movement impressed, whether of sensible translation in space, or of wave motion of particles, i.e., vibration, as shall not be expended in *deforming* the flexible india rubber, will be delayed, but still passed on, to the interior core of steel. As in india rubber the range of deformation—the limit of elastic recovery—is very great, so but a small proportion of the original impulse *may* be propagated on to the core; but for any practical *bearing* purpose, an axle immersed in such a "wobbling" and unstable material would be useless. Suppose, however, that the intermediate material were lead or tin (soft metals), the blow, as before, will be expended partly in deforming these, and the residue be passed on to the core; but here there is practicably no elastic recovery of form—a little of the soft metal will be battered out somewhere at each blow, and will soon part company both from "core" and exterior hard coating. Lastly, assume that such a soft metal is confined at all sides, so that it cannot escape from between the hard ones, and cannot be *deformed*, then it will propagate the blow, not at precisely the same velocity, but nearly with its full force, to the interior core; and so will india rubber, if confined on all sides, except in so far as it may be capable under such condition, of being deformed by change of *volume*, i.e., by being condensed and recovering its volume again.

For any practical good that could come of this invention it might quite as well be attained by wrapping the axle up in Welsh flannel, or putting a diachylon plaster upon it. The very idea of "insulation from vibration" is only exceeded in confusion by Mr Hood's notions, that we have already referred to, of "insulation from magnetism." As well talk of insulation from gravity—of insulating a body from its own weight. Magnetism, in one or other of its polarities (magnetism or diamagnetism), is as universal as gravitation itself, and affects every body in the known universe.

In clearing the ground before us by thus pointing out the prevailing ignorance shown by mechanical men upon this important subject, we have had to occupy so much space, that we must reserve to a future part our exposition of the true laws of metallic aggregation, and of the changes effected in it by alterations of form; but, meanwhile, let us a little farther clear away some rubbish, by asking some such questions as the following—a multitude similar, and better even, might easily occur:—

If it be true that vibration, *per se*, long enough continued, without any qualification as to range or extent, or vibration accompanied by alternations of temperature, or by these along with alternations of steady strain, or if it be true, that all these together are capable of changing the internal crystalline arrangements of the metals in use in the arts (or of any metals), and making them brittle—reducing their ultimate cohesion, and causing them to become untrustworthy—how are such things as the following to be accounted for, and yet the dictum hold?—

There are numbers of watches that have been in use fifty years and upwards, wound up every night and run down during the day. The main-spring has been coiled and uncoiled more than eighteen thousand times; nay, the fine balance-spring, which moves 86,400 times as fast, and is compressed and extended through a greater proportional range at each heat of the watch, has been coiled and uncoiled, the inconceivable number of Fifteen Hundred and Seventy-six Millions, Eight Hundred Thousand times. Now, if the elasticity of either spring were seriously, or rather were at all altered, it would be indicated in the most certain and *multiplied* manner by the watch constantly losing time, while, of course, if the springs became brittle, they would cease to be springs altogether.

There are old organs abroad, of more than four centuries old, that, day by day,

> "From matin call to dewy vesper hour,"

have been resonant and vocal, while twelve generations of the pious fingers that have awakened their music, have in succession stiffened and died. Yet, there stand the old organ pipes, metal and wood, and emit the same notes they did on the morning of their dedication. Yet a change in the elasticity of the metal, of which any one of them is made, to the extent of even a five hundreth part of the modulus value, would have become audible and noticed, and the musical value of the interval between every pipe in the organ would have got gradually out of tune, and in a degree different between every two successive pipes in the instrument. We don't find it so. The strings of old harpsicords, or spinets, or of the oldest pianofortes known, cannot be brought into case, because, from the material of which the frame is made, these instruments are perpetually getting out of tune, from causes altogether foreign to our inquiry; but had we a pianoforte, with an absolutely immutable back, so as to admit of any conclusion, then, if it be true that vibration in the end produces brittleness, and it be a law universal that effect, is proportional to force, as cause, we should inevitably find some of the strings at one part of the scale in *every* piano breaking in preference to any others.

But the misty philosopher will say, "Oh, these are very gentle vibrations, and they are not accompanied by percussion." What do you mean by *gentle*, my friend? Do you mean *slow*, or that the *range* is small? In the instances given, neither is the case. The velocity of the wave is dependent on the elastic modulus (chiefly) of the vibrating body, and the amplitude is not small either; in the smallest instance given, that of the organ, it is large enough to make windows rattle, or even, it is said, to break them ere now. But we will take a case or two rough enough, and with percussion.

There are some ancient minster bells in Southern Italy, which the writer has seen and measured, that were cast in the twelfth century, have been tolled and rung, day by day ever since, and are ringing now. In these, the construction of the tongue or clapper, is such that it has always struck upon the one pair of spots, at opposite sides of the interior of the bell, and, at these, two deep indents have been made by the iron ball, equal to more than a third of its diameter in depth, and the hard and brittle bell metal, has slowly become embossed up, round the edges of the indent, as though the clapper had beaten upon a very malleable material. If one of these bells has been tolled only fifty strokes per day during the five hundred and odd years of its life, it will have sustained nine millions, one hundred and twenty-five thousand blows, and, by the same number of blows, its circular form will have been changed into ellipses, whose major axes have been alternately in the line joining the indents, and at right angles to the same, perhaps one hundred times for each blow, or, in all, *nine hundred millions of sensible vibrations*. Yet the tone of the bell has not altered as respects the others in the peal, and if all the bells had altered in tone they must have varied by unlike intervals, and so indicate it by being now out of tune.

One example more. We will take the hoop-tyre of the wheel of a London cab. It is, say, 4 feet diameter, and on a cab that has run an average of twenty miles a day for five years (probably a period a good deal within the average life of a cab, though, we fear, beyond that of "the oldest inhabitant" in the shape of a cab horse). If we take the average thickness horizontally of London street pitching to be six inches, which is rather above it, the circumference of the tyre bar will have received, at the end of the fifth year, nearly three hundred and eighty-six millions of blows, many accidentally repeated over and over again, in the same spot, and others not. The blows are no gentle ones. The average speed of the cab we may take at more than six miles an hour, or nearly nine feet per second, and the insistent load upon the wheel at about 400 lbs. (all included.) Each blow, then, upon hard unyielding granite knobs, each striking the iron at almost a single point, is equivalent to the shock of a mass of granite of 400 lbs. weight falling upon it from a height of about 15 inches. Were it not that a large proportion of the impulse is expended in deforming, i.e., in altering the form, of the wheel itself, and then that of the carriage springs (which themselves have as many vibrations impressed upon *them* as there are blows given to the wheels), the whole carriage would be rapidly shaken to pieces, even at this moderate speed; but, at every blow, the wheel tyre is *bent* transversely more or less at the point of impact, and these repeated bendings take place in a small bar of not more than about 2 in. × ½ in., already subjected to a constant dead strain of probably about a ton to the inch of section (much more when the wheel is new and wetted for the first time), due to the grip of having been shrunk on. Now how seldom do we observe a cab wheel tyre suddenly snap in twain—how *very* seldom, without a defect in the material or bad shut showing itself.

We have thus given a tolerable array of instances of long-continued and of violent vibration, in which the proof amounts to there being no possible change produced by it in the molecular constitution of the metals concerned, and amongst these we have one of the hardest and most brittle known, bell-metal; the hardest and most highly elastic known, tempered steel; the softest and most inelastic class (pewter and tin) in organ pipes, and copper in stringed instruments; and lastly, iron, the subject of debate, possessed of a high degree of hardness and elastic, but of imperfect elasticity. And now, before concluding for the present, let us ask another question. In the face of these striking examples of the absence of all change from shocks and vibrations, &c., continued for ages, how is it to be accounted for that no cast iron gun has ever been known to fire more than six or seven thousand rounds before it bursts?—that is to say, that no cannon will bear more than that number of shocks and vibrations without destruction—few will bear one-third of the number? If the reader can himself supply the answer, he already has the key to all this part of the enigma of vibrations.

We have cleared the foundation, and hope to place the edifice of the just philosophy of the subject before our readers in our next.

FAN BLAST.

Amongst our correspondence this month will be found a communication from Mr John Sked, of Woolwich, containing some interesting facts in the history of the Fan. We very much doubt the opening statement, which attributes the invention, or, at least, the earliest known use of the fan (as a winnowing machine) to the Chinese. A truly philosophic history of human invention, as regards especially the primary agents of civilisation, such as agricultural machines, fermented bread, the ruder metallurgy, and so forth, remains yet to be written. Beckmann and others treat the subject as mere archæologists, and never entertained the thought, that the link of connection, the method by which the first glimmerings of human enlightenment must be traced to their remote origins, far behind the reach of any written or even traditional history, is the same in character as that of philology, and of ethnology, as derived from it. We must trace the course of human inventive progress, by tracing the migratory progress of the human race itself, as developed by the never-ceasing wear and reproduction of human tongues;—an "organon" of discovery of which Professor Max Müller has been the first and most eminent expounder, in England at least. It would be out of place in this Journal to pursue too learnedly the subject of very early inventions. We believe, however, it may be shown on good grounds that very few indeed of the older and more primary inventions of mankind have reached our Western world, seaward from China, or the remote East. They have rather come, borne by the advancing tribes of the human family, from their (so far as we as yet know) primordial nomad seats in Central Asia, and have been developed on the journey as the wants of men demanded, and as the means already acquired permitted; and thus, no doubt, some very early inventions were independently made, in common, by very early peoples, in Asia and in

Europe. As respects the fan, applied to winnowing, we know of no good authority for its having been known and used in China or India, or anywhere in the East, *before* examples may have been presented to these peoples from Europe. If the invention were a very early one in the East, the character of its social system, "which altereth not," would cause it to be found in use at the present hour, in, most probably, precisely the same form and mode that it would have been in the days of Alexander the Great; and as everything of invention, and of learning, has moved westward from the rising sun, along the broad highways of the Arabian Seas and the Mediterranean, so in the "half-way house," in point of time (and indeed also of position) afforded by the Jews and their early records, we should discover evident traces of *their* use of every invention of primary importance to an early people, *provided* that the invention had a prior and more oriental existence.

Tested by this process, it would seem to be certain that the revolving fan for winnowing, is not an ancient oriental instrument; and it becomes highly probable that it is a comparatively modern European invention, and belongs most likely to the early middle ages and to Germany. "Whose fan is in his hand, and he will thoroughly purge his threshing floor" is the language of Scripture, and indicates that, nearly 2000 years ago, winnowing was performed in Syria and Palestine, as it is to-day, there and all round the shores of the Mediterranean, by the current of air from a broad fan held in the hand. By this method, or by that (also widely diffused) of taking advantage of a natural current, and throwing the chaff and grain together into the air, we believe winnowing is now performed everywhere by the natives of India.

If it be worth while to trace early invention at all, it is to be attempted with accuracy; and we are far from admitting that there is no practical bearing or fruit to the practical inventor in such investigation. In fact, it is only the narrow mind, of the half-educated, that can see "no practical good," except in the concrete, and already utilised, of human knowledge. The better informed, he who has begun to understand the totality of human progress, and the deep sources of the hidden springs, that supply the ever-increasing volume of its stream, knows that all has been fed, and every epoch of improvement marked, by abstract speculations and discoveries of nature, which the "practical men" of the day, in this worst and most improper use of the term, could see no use or value in whatever.

We should be glad if our correspondent pursued further his history of the fan, and advanced it in a future communication, in a direction far more valuable than the inquiry as to its early infancy, namely, by condensing into a connected narrative whatever is available of the theoretic and experimental knowledge we have of centrifugal blowing machines (which may properly include the subject of centrifugal pumps), and giving us the history of the various modifications of practical construction, proposed or applied in different countries.

Centrifugal machines, generative of current movement, whether in elastic fluids (fans), or liquids (centrifugal pumps), or in either, when acted on along with solids (centrifugal drying machines), constitute a class of instruments of very high importance and wide application for various manufactures and purposes, and are made and multiplied unceasingly. Their construction is, however, still to a great extent (indeed almost wholly) empirical.

Every centrifugal machine, whether fan or pump, depends for its efficiency upon what proportion of the *deviating force* (which is the only portion of the total force employed, that can be available to produce a current) is advantageously consumed, i.e., returned in "duty."

This deviating force, which we may call, R, (the total force being divided between this the normal, and the tangential one) is

$$R = \frac{W v^2}{g r} \text{ the mass in motion being } \frac{W}{g} \text{ with the angular motion,}$$

v, and radius, r.

We can increase the deviating force, by increasing the angular velocity as far as we please; and can do this either by increasing the absolute velocity, or the radius, of the fan; but we shall not produce a corresponding increase either in the manometric pressure, or in the issuing velocity of the blast.

The question, what is the best proportion between radius and velocity of rotation for a fan to produce a blast of given power, is one quite unsettled, and one that nothing but a carefully conducted set of experiments guided by Pneumo Dynamic science can fully solve. There have been three or four marked distinctions in structural form given to the fan, each propounded as the *ne plus ultra* of perfection. These are, the older cylindric fan, with radial blades; the eccentric cased fan, with inclined or curved blades; the fan in which the blades revolve with circular disc cheeks at either side, along with them, to prevent air passing back at the edges of the blades; and, lastly, the hollow curviform boss to the axis of rotation, which forms the improvement of Schele, late of Lancashire. We are not aware of any good experiments as to which of these is best, or whether any one of them is better materially than the old circular form first in use. If the object in view be to set the *largest possible volume* of air in motion with a low velocity, there can be no doubt that the fan with fixed side cheeks, and without any circumferential casing, i.e., open all round, such as that designed by Mr James Nasmyth, C.E., for Abercairne Coal Pit, South Wales, and now at work there for several years, is the best. We are by no means convinced, however, that the radial blades adopted by Mr Nasmyth, are the best for this or any purpose.

When, on the other hand, the object is to obtain a blast for cupolas, or forge fires, &c., at a considerable pressure, we think the choice of construction, "as at present advised," much more difficult and doubtful. We much doubt the advantages of the revolving side cheeks (the third variety mentioned above) in any case, both on grounds of theory and of practical construction. The relative proportions of the parts of all the forms is mere matter of dictum, so far. The rule propounded by (we believe) Mr Buckle, that the width of the blades should be 0·25, the diameter and the centre side apertures of indraught 0·5, the same diameter, seems to rest on no better basis than the fact that then the cylindric surface at the inner edge of the blades, will be equal to the area of indraught—a condition far from conclusive as to proportion.

That the efficiency of the fan rapidly diminishes as the velocity and pressure of the blast are augmented, appears unquestionable, but in what proportion lessened, no one knows. Mr William Fairbairn is understood to have advocated, some years since, the substitution of fan blast, for cylinder blowing machines in the blast furnaces of iron smelting works, and we believe that, at his recommendation, some large experiments were made. The mode proposed of bringing the pressure up to the required point was by receiving at the indraught of one fan the blast delivered by a preceding one, each fan, of several in the series, having a greater and greater velocity. The results, we have been informed, were wholly unsatisfactory, and, indeed, failure might have been predicted in such an arrangement on theoretic grounds. It would be very desirable that Mr Fairbairn, to whom applied science is under many obligations, would make public the method and results of these experiments.

For blast at a high pressure, our own pretty fixed opinion is, that as with the centrifugal pump, for very high lifts, the return in duty will be ruinously low. As regards the more general question, we know of no comparative experiments that have ever been instituted, of a conclusive character, between the "duty" of the fan (as an engine for producing blast) and that of other forms of blowing machine, such as the cylinder, the water plunger, the Archimedes screw, &c. It is commonly reputed a very economical blowing machine, and is so, undoubtedly, in small outlay and facility of putting in motion; but as to its large yield of "duty," at anything like furnace or cupola pressures, we suspend our judgment, inclining meanwhile to the view, that neither fan nor centrifugal pump are the highly economic machines that their makers represent them to be. The trials made at the Exhibition of 1851 of Appold's and of Gwinn's pumps, while they conclusively proved (what might have been known without any experiment) the inferiority of the radial blade, gave no trustworthy results as to the ratio between power expended and work done, and the results, such as they are, only apply to a restricted range of heads. Any engineer engaged in unwatering foundations, &c., by means of centrifugal pumps, who will measure the discharge, indicate the steam power consumed, and give the particulars of structure of the pump, and velocity of rotation, &c., will do good service. M. Combes, the distinguished French engineer of mines, has investigated, at considerable length, the application of the fan to mine ventilation, and his results throw a good deal of theoretic light upon the machine for whatever use, and clearly indicate the disadvantage of Mr Nasmyth's radial blades. Dr Ure and Mr Buckle are the only two authors, we believe, who have written on the subject in English.

Our aim has not been to write a treatise, however brief, but to point out some of our ignorance, on a subject of great practical importance, and of multifarious applications, and to recommend it to those of our readers who possess the means of adding to our knowledge, either theoretic or experimental.

SEA-WALL ENGINEERING.—LINCOLNSHIRE FEN DRAINAGE —THE DYMCHURCH WALL OF ROMNEY MARSH.

The continued incursions of the ocean upon the margin of our little island have afforded, from time long since immemorial, matter for deep consideration on the part of landowners, and their effective right arm, the engineers; and, in tracing the curiously irregular outline of the British sea-board, we come, ever and anon, upon what are, even in these days of giant engineering, vast artificial barriers and drainage works, which have been erected for the repulsion of the waste of waters around us, for the carrying off of surface water from flat, low lying tracts of alluvial soil. Of enormous drainage operations, combined with embankments, by far the most prominent example is to be found in Lincolnshire. The great level of the fens, 70 miles long by 30 broad, containing about 680,000 acres of the richest wheat growing land in England, may be very favourably compared even with what the industrious land reclaimers of Holland have accomplished. This vast area, once a dank, reedy, useless waste, is now covered, year after year, with splendid waving cereal and green crops, hardly to be matched elsewhere; and what was once either washed by the German Ocean, or well nigh hopelessly saturated with the irregular natural drainage waters from the high ground forming the inland boundary of the immense level, has been most effectually rescued from the ravages both of the waters of the sea and the falling rains from heaven, and converted into smiling food-giving fields.

This work was commenced, it is supposed, at a date anterior even to the immigration of the Romans, and it has been carried out to the condition in which we now see it, by assiduously intercepting the drainage from the more elevated ground, by judiciously guiding the courses of the rivers, and by banking out the sea. But to the Romans we must accord the credit of being the earliest reclaimers of the rich alluvial deposit fringing the shores of the "Wash," now known as Marshland and South Holland, and very little doubt exists as to their having constructed the enormous drain still known as Carr Dyke, 40 miles long, with a continuous breadth of 60 feet. This is the great interceptor or catch-water drain for receiving and conveying away the high land and flood waters, and restraining them from ruining the now luxuriant flat. Of this ancient piece of work it has been said by one of the ablest of modern engineers, that it is most judiciously contrived and admirably laid out. It is now, however, in a somewhat dilapidated condition, for age has told upon it, as it tells upon everything else.

Whittlesea Mere, on the same coast, once, as its name indicates, a vast waste of sea water, is another instance of what a succession of drains and dykes has done in practically adding to our available crop producing soil, a result greatly forwarded by the labours of the monks of Croyland, Thorney, and Ramsay, who rescued their respective islands from the waters everywhere around them. The first great draining engineer on these once drowned islands was the Dutchman, Cornelieus Vermuyden, who found them a barren wilderness of water, mud, and ooze, and left them fruitful, salubrious, and healthily habitable for man.

Crossing over to the opposite side of the island, we find an example of land reclamation of a very different, and, in some respects of a higher engineering character, although it bears upon a very much smaller area of country than that of the Lincolnshire fens. This is the great sea-wall of Dymchurch, which guards the beautiful agricultural level of Romney Marsh, a vast level without a single hillock to relieve its flat expanse, and forming part of the extensive low-lying ground which extends from the cinque port town of Hythe, in Kent, to the old fashioned and picturesquely situated Sussex cinque port, Rye. This level embraces an area of 60,000 acres, of which amount 24,000 acres are thoroughly drained, and walled in from the sea, forming Romney Marsh proper. This magnificent level, generally considered to be the greatest sheep-feeding district in the kingdom, is thought by some antiquarian inquirers to have constituted an arm of the sea in former times, where ships could ride in deep water, and where sea-fights have taken place in savage times. Other authorities adhere to the view that it was never anything but a large swamp, covered at times by the tides in many place, and by the waters of the river Limene, now called the Rother.

The "Liberty of Romney Marsh," contains, either wholly or in part, thirty-one several parishes. This marsh was known to the English Saxons by the name of Merscwarum, and in a grant of King Offa to Archbishop Janibert, about the year 795, it is termed Merscware, the aboriginal inhabitants being called *viri palustres*, marsh or fen men. It is highly interesting in an antiquarian and historical point of view, for it was on this ground, or that in the immediate neighbourhood, that Cæsar first placed his foot when he landed for the avowed purpose of subjugating our barbarian ancestors. But it is more than probable that, long before the Roman incursion, the tribes from Belgium and Friesland brought over contrivances of their own for embanking and draining the marsh lands, preparatory to their settling upon them. To the Friesians, indeed, we may be said to owe what, as is jocularly said of its own inhabitants, is regarded by them as the fifth division of the world, when they describe the globe as consisting of Europe, Asia, Africa, America, and *Romney Marsh.*

This very important fifth of the world is fourteen miles long, and eight miles broad; and, as its entire surface level is some ten feet beneath the level of the spring tides, it is screened from the effects of the sea by a formidable marginal wall, three miles in length. It is upon this wall that the safety of the now highly cultivated marsh ground entirely depends; and hence, every device which engineering ingenuity could contrive has been, and still is, held in continual requisition for providing for the outflow of the surface water through the numerous drains and ducts which everywhere intersect it, and for defying the insidious and sometimes terrible effects of the combined action of wind and water. The wall, which is the great engineering feature of these reclaiming works, is called the "Rhee Wall," or "Dymchurch Wall," the latter name being given to it from its running along the sea shore directly in front of Dymchurch, a quaint little town, where are the head quarters of the government, and where are administered "the law and custom of Romney Marsh."

The perpendicular height of this wall varies from 12 to 20 feet, and it has a good road along the top, of a width varying from 15 to 30 feet. The sea face is of solid stonework, and it forms at its base a shelving irregular beach, carried out artificially to the extent of a hundred yards or upwards. The drainage is effected by arched sluices passing under the banks, each sluice having two pairs of flood-gates, one pair being on the outside, and the other on the inside, to provide against any casualties which may befall the external gates. By these means, the ramified drains or sewers of the entire marsh being made to converge with the main ducts leading to these outlets through the wall, the surface waters are passed off from inside the wall, at low water, whilst, as the tides rise, the ingress of sea water is effectually prevented. The main body of the wall is composed of a vast body of earth, and it was originally defended from the sea by numerous rows of strong timber piles, on which were fastened planks and faggots, forming a "raddle" work. Straw was also tried as a sea facing, according to the Dutch plan, but, in spite of its slightly yielding yet protective action, its use was ultimately abandoned, for it could not withstand the tremendous seas which wash up against the wall. and, consequently, it was rapidly torn away. Now it presents a uniform face of roughly hewn stone blocks, and is really a remarkable piece of engineering construction, eminently suited for its special purpose of standing guard over the cultivated soil within it.

The cost of keeping this great wall in repair averages about £4,000 a year, and it is defrayed by rates, known in the Marsh language as "Walling Scots," levied by the "lords of the Marsh." Similarly the costs appertaining to the drainage works are met by the imposition, under the same auspices, of "Watering Scots." Whence arose the term "Scots," no one living or dead, seems to have ever known. Certainly, no one now living can throw any light upon it, and none of the ancient papers, of which there are many still extant, give any explanation of it; there is no written or printed record of the when, how, or where it arose, unless we take the old expression, "Scot and lot" as its origin. "Walling" and "watering" do dimly indicate their object, although by what etymological rules of either ancient or modern language they came to be thus applied, we cannot by any means clearly see. Romney Marsh was incorporated by a charter granted by King Edward VI., confirmed by subsequent charters—one of which from Henry III., is now before us—under the style and title of "the bailiff, jurats, and commonalty of Romney Marsh, in the County of Kent." To this day, however, "the law and custom of Romney Marsh," though at first, and for unreckoned time, unwritten, lies at the base of all English legislation on the great subject of embanking and draining.

In the charter of Henry III., written in by far the most extraordinary Latin we ever read, we find it stated that, "Because by foure and twenty lawfull men of Romney Marsh (time out of minde) hereunto chosen aud sworne, distresses ought to be made upon all those w^ch^ have land and tenements in the said Marsh, to repaire the said walles and water-gauges of the same Marsh, against the daungers of the sea; and also upon all those which are bound and charged for the reparation of the said walles and water-gauges: We have granted to the same foure and twenty, that, for the safety of the said Marsh, they cause those distresses to be done, so that they be made equall, according to the portions, greater and lesser, which men have in the same Marsh, and according to that which some are bound and charged. And, therefore, we will and grant, that none of our Sheriffes of Kent, or any of his bayliffes, doe in any wise intermeddle touching those distresses made by consideration of the same danger; for whosoever shall bring complaint unto us of the consideration of those distresses, we will cause justice to be done unto him in our own court." The phrase "walliarum and water-gagiorum," in the original, would, we suspect, hardly pass muster with Cæsar, in the face of his justly celebrated Commentaries. The corporation was appointed to consist of a bailiff, 24 "jurats," and all the adult male householders resident within the limits of the marsh; the corporate officers to be a bailiff, four justices, a chamberlain, a seizing officer of wrecks, fines, and forfeitures, a clerk, a serjeant or minister to the bailiff, and a jailer; the conservancy of the drainage, and sea-walls of the level, was vested in 23 lords of manors in and adjoining the Marsh, and called the "Lords of the Marsh."

This is the constitution of the Incorporation to the present day, and "the custom of Romney Marsh" prevails all over Kent, in the Isle of Thanet and Sandwich, and along the low marsh lands in the valley of the river Stour, where reclamation works were also carried on at a very early date.

The "bailiff," or presiding genius at the head of the operations, has always been chosen from amongst the leading men of the Marsh, whose interests were inseparably bound up with those of the great work in hand. To this most judicious mode of selection, no doubt, we must attribute very much of the splendid success which has all along attended the efforts of the conservators of the rescued land. Charles Rolfe, Esq. of Bilsington, a parish partly within, and on the landward margin of, Romney Marsh, is the present bailiff. He is the most extensive landholder within the liberty, and this, combined with his great energy, decision of character, and thorough knowledge of the agricultural character, as it is, was, and should be, of this peculiar district, renders him pre-eminently fitted for so responsible and honourable a post.

Many of the most eminent of our civil engineers, including Sir John Rennie, have tried their professional hands upon this undertaking. The practical management of the works is now, and has been for the last 20 years, under the direct superintendence of Mr James Elliot, Jun., of Dymchurch. Much is owing to him for the energy and practical sagacity which he has displayed not only in keeping old works in order, but as well in devising new means for the remedy of new disasters, as there occasionally arise. As we have touched upon the antiquities of the district, we may mention, *en passant*, that the manorial tenure of Bilsington is quite of a piece with the other antiques of the neighbourhood. The manor of the parish was held in grand serjeantry, in the reign of Edward III, by the service of presenting three maple cups at the king's coronation, and, at the time of the coronation of Charles II., by the additional service of carrying the last dish of the second course to the king's table.

The late Sir W. Cosway performed this service at the coronation of Her Majesty, and thereupon received his knighthood.

HISTORY OF THE SEWING MACHINE.

XXXV.

(*Continued from Page 257, Vol. V., Second Series.*)

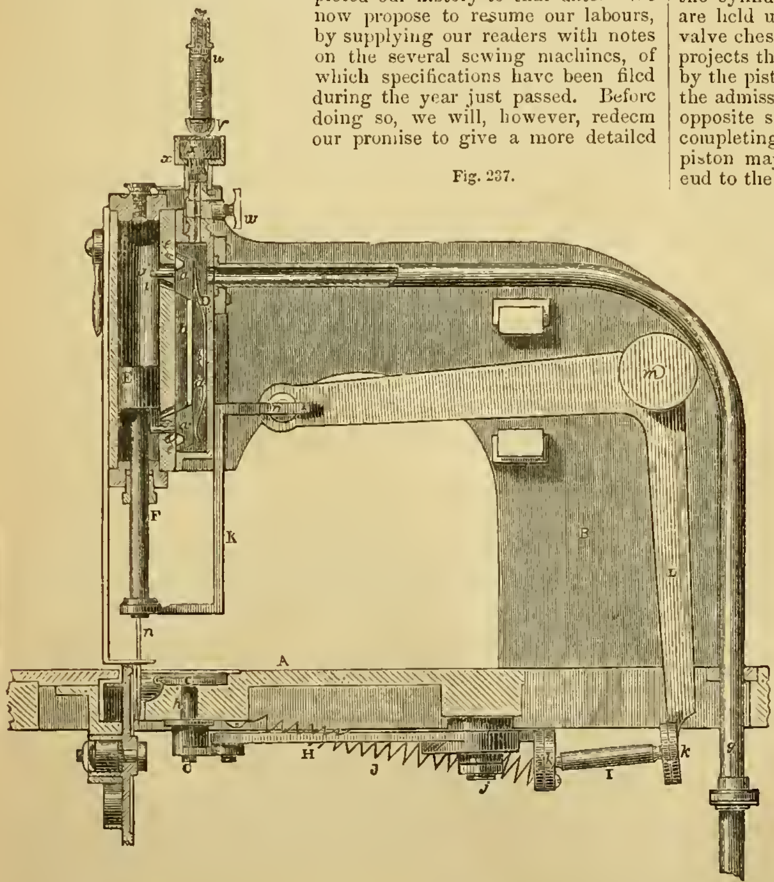


Fig. 237.

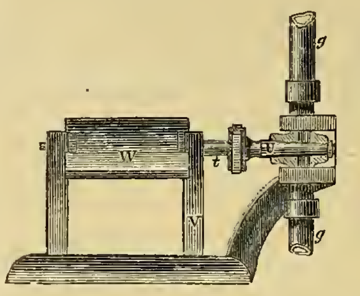


Fig. 238.

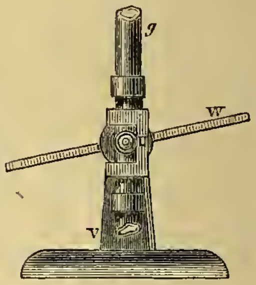


Fig. 239.

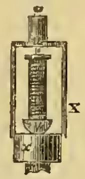


Fig. 240.

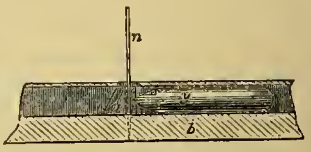


Fig. 241.

TWELVE months have elapsed since we laid down our pen, after having given a brief outline of the last of the complete specifications of sewing machines enrolled in 1860, and completed our history to that date. We now propose to resume our labours, by supplying our readers with notes on the several sewing machines, of which specifications have been filed during the year just passed. Before doing so, we will, however, redeem our promise to give a more detailed notice of a curious machine, invented by A. G. Allen, of New York, and patented in this country, by Mr W. E. Newton, on the 8th of June, 1860. On referring to the concluding article of our history, p. 257, Vol. V., the reader will find an abstract of the specification of this patent, of which we now propose to give such illustrations as will explain the nature of the claims more clearly. Fig. 237 represents a vertical longitudinal section of this machine. A is the bed plate, having fitted thereon the bracket or standard, B, which is provided at its front end, in the place usually occupied by the needle bar guide, a vertical cylinder, C, and valve chest, D. Inside this cylinder, works a piston, E, the rod, F, of which has the needle, *n*, attached to its lower extremity, and constitutes the needle slide or carrier, it being guided in its vertical movement by the piston, and the stuffing box at the lower end of the cylinder. The cylinder is closed at its upper end, and the valve chest is kept constantly filled with the compressed air employed as the motive agent by the pipe, *g*. The valve chest extends nearly the whole length of the cylinder, and contains two short, D, slide valves, *a a'*, connected by a rod or plate, *b*, and fitted to two flat seats, or valve faces, which are parallel with the length of the cylinder. Each of these valve seats contains a port, *i*, leading into the cylinder, and a port, *e*, leading into the atmosphere. The valves are held up to their seats by the spring, *d*, secured to the back of the valve chest; and each valve is provided with a stud or pin, *f*, which projects through its port, *i*, sufficiently far into the cylinder to be struck by the piston, E, as the latter, in its reciprocatory motion produced by the admission of the compressed air or other fluid to the cylinder on its opposite sides alternately, arrives near the end of its stroke, so that in completing its stroke towards the top or bottom end of the cylinder, the piston may move and adjust the valves, opening the port, *i*, at that end to the chest, D, and bringing the corresponding port, *i*, at the other end, into communication with its respective eduction port, *e*, to permit of the exhaust to the atmosphere of the compressed air, which has already acted upon the piston, by which means the reciprocatory motion of the piston is maintained, and the necessary vertical movement imparted to the needle, *n*. The necessary movements of the shuttle, *y*, or other device employed in combination with the needle for producing a lock or double-looped stitch, and the movement also of the feed mechanism, are obtained from the piston rod and needle holder. In our illustration, the shuttle driver, G, works in suitable guides, *h h*, and is connected by a link, G', with a horizontal bell crank, H, working on a fixed centre at J, and connected by a link, I, and two ball and socket joints, *k k*, with the lower arm of a bell crank lever, L. This lever works on a fixed centre, *m*, in the bracket, B, and has the front end of its upper arm connected by means of the bent rod, K, with the lower end of the piston rod and needle carrier, F—this rod being connected rigidly with the latter, and fitted loosely into a slot in a rocker, *n'*, the journals of which are fitted to bearings in the sides of a fork at the extremity of the lever. J is a spring for overcoming the weight of the moving parts, and so maintaining the needle always in an elevated position when the machine is at rest. The feed mechanism shown is the well known wheel feed, the friction dog of which is actuated by the lever, H, striking an inclined surface on a lever, which is connected by a link to the lever of the friction dog. The compressed air pipe, *g*, should be furnished with a stop cock, by which to stop, start, or regulate the speed of the machine at pleasure. In large establishments, where several machines are used, it is proposed to arrange them in a line, and to convey the compressed air to each machine, by a separate branch, from a main pipe running along the apartment, each branch being fitted with a stop cock, to enable each operator to control her machine. The most convenient arrangement of pipes and stop cocks is shown at figs. 238 and 239. The pipe, *g*, passes near the floor, under the machine; the stop cock, U, is connected with a small shaft, *t*, which is arranged in bearings in a small stand, V, secured to the floor, and which has secured to it a double treadle, or foot rest, W, upon which the operator keeps her foot balanced in such a way as to be able to press down the front or back part, and to control the opening or closing of the cock at pleasure, and thereby to start, control the speed of, and stop the machine, without taking her hands from the work.

The spool holder, and the turbine wheel for driving it, are shown in fig. 237. The spool holder consists of two centres, *u* and *v*, the lower one, *v*, being made in the form of a cup large enough to receive one head of the spool, E, shown in elevation at right angles to fig. 237, in fig. 240, and attached to the top of the small turbine wheel, *x*, fitted inside a box or casing, x', arranged above the valve chest, D, and having its bottom connected therewith by the short pipe and stop cock, *w*; the upper centre, *u*, is fitted to the top of a frame, *x*, which is secured to the top of the turbine box, x', a spring being applied to press the centre downwards. The spool being placed between the centres as shown, and the stop cock, *w*, opened, a portion of the air from the valve chest rushes through the turbine, and causes it to rotate rapidly, carrying round with it the lower centre, *v*, and the spool. This peculiar method of driving a sewing machine, above described, necessitates the simultaneous and continuous movement of both the needle and shuttle, and consequently, both sides of the loop are at the same time in contact with the shuttle, in place of the needle being interposed between the shuttle and one side of the loop, as is the case when the needle pauses whilst the shuttle is passing the loop. In order to prevent the rolling or chafing of that side of the loop which is unprotected by the pressure of the needle, an oblique recess, *a*, (fig 241) is made in that side of the shuttle race, *b*, on which the needle works, so as to receive the side of the loop which comes next that side of the race. This recess commences where the needle enters the race, and extends downwards and obliquely in the direction of the shuttle's motion when entering the loop as shown. The nose, or tapered portion, *c*, of the shuttle carries the loop along with it, and before the straight portion arrives within it, carries it into the recess, *a*, where it is protected from abrasion during the passage of the straight portion of the shuttle.

Wm. Campion and Wm. Campion, of Nottingham, obtained provisional protection on the 28th of June, for an invention, the object of which is the production of a simple, economical, and expeditious sewing machine. How these desirable results are to be accomplished is not so clearly explained in the document before us. The machine, according to one arrangement, so far as we can make out without the assistance of a drawing, appears to be a tambour or chain stitch machine, provided with a hook which is carried by the driving shaft, and serves to hold the loop whilst the needle passes through it. We certainly cannot discover much novelty in this. Another alleged improvement relates to shuttle sewing machines, the shuttle working in a race, and driven by a bolt having a pin in one end which works in a groove in the circumference of the driving wheel. A peculiar shuttle is also referred to, consisting of a bobbin having one end flat, and the other end rounded. The flat side lies upon a flat piece of metal rounded at one end, and is of the same size as the bobbin, whilst the other end projects the distance of half the circumference beyond the bobbin, at which distance it terminates. The part which projects turns over from the point, each side being bent over a portion of the round end of the bobbin; and the bobbin is kept in its position, on the round end of the plate, by a light spring, in which is riveted a pin, which passes into a hole in the centre of the bobbin, the opposite ends of this spring being soldered into the pointed end of the shuttle.

Hobert Henry Bishop, of the United States, obtained a patent on the 2d of July, 1860, for improvements in sewing machines, consisting essentially of a peculiar mode of effecting the feed of the cloth, by means of a lateral vibratory motion imparted to the needle—a peculiar arrangement of looping instrument for interlooping a second thread with the needle thread, and a mode of regulating and adjusting the pressure of the presser foot upon the cloth. The stitch produced by this machine is precisely similar to the Fisher & Gibbons', and Grover and Baker's stitch; but the mechanism for producing the same will not bear comparison with that of Grover & Baker's machine on the score of simplicity. In order to obtain the lateral motion of the needle required for feeding the cloth along, the needle bar is suspended, at its upper end, from a pin in the top of the vertical slide, which usually carries the needle so as to be free to oscillate on such pin in a lateral direction, whilst it is being carried up and down by the vertical motion of the slide. A bell crank lever, and adjustable stop, serve to impart the desired lateral motion to the needle bar. Figs. 242 and 243 represent respectively a side and front elevation of a portion of this machine. A is the front end of the fixed arm or overhanging bracket, common to all sewing machines, and B is the ordinary vertical slide working therein, and actuated by a bell crank lever in the usual manner. D is the needle bar, which carries the eye pointed needle E, at its lower end, and is connected by the pin, F, at its upper end, to the top of the slide, B. A lug is formed on the lower end of the bar, D, which projects under the lower end of the slide, B, where it enters a cross groove, and thus keeps the bar, D, against the face of the slide. A small bell crank, G, working on a centre, *a*, in the slide, B, and consequently rising and falling with that slide, gives the lateral motion to the needle. The needle bar, D, is recessed to receive the vertical arm of this bell crank, which is introduced between the bar, D, and slide, B, the lower end of the arm being forked to embrace a pin in the bar, D, as shown in dotted lines in fig. 243, the needle being therein represented in its lowest position. The horizontal arm of the bell crank, G, works over the end face of the bracket, A, and strikes in its up and down motions the respective stops, *b* and *c*. The effect of the upper stop, *b*, is to turn the bell crank on its centre, and cause the needle bar, D, to be brought into a perfectly vertical position, in readiness to descend through the cloth. Before the needle, however, has completed its downward stroke, the bell crank comes in contact with the adjustable stop, *c*, and moves the needle bar laterally. As such lateral motion takes place while the needle is in the cloth, it follows that the cloth will be drawn along with it, in the direction of the lateral motion. The needle then rises, and just before it has completed its upward stroke its bar, D, is returned to a vertical position again by the striking of the bell crank against the fixed stop or pin, *b*, so that the needle on its

Fig. 242.

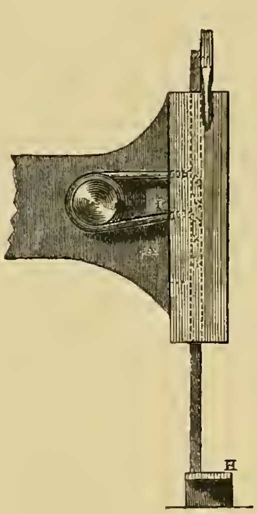


Fig. 243.

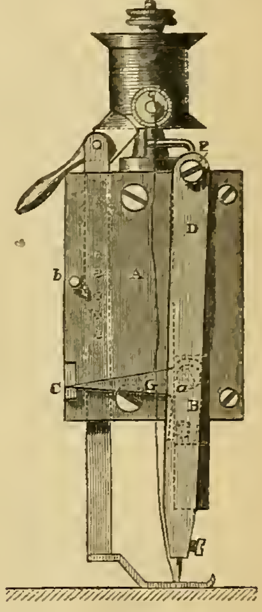


Fig. 244.

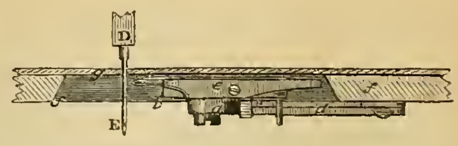
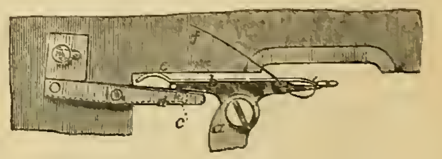


Fig. 245.



next descent will pass through another part of the cloth—the length of the stitch thus produced depending upon the amount of lateral play of the needle bar when the needle is in the cloth, and this is regulated by raising or lowering the adjustable stop, *c*, so as to cause the lateral movement to commence at an earlier or later period of the needle's descent. H is the presser foot, which is held down upon the cloth by the bent spring, I, a series of notches being made in the stem of the presser foot, with any one of which the end of the spring, I, may be engaged, so as to increase or diminish the tension of the spring, and thereby regulate the pressure on the cloth. Figs. 244 and 245 represent (full size) a side view of the peculiar looper, and an inverted plan of the same. These views are not at all clearly delineated in the specification, but our readers will probably be enabled to trace the intended meaning of the inventor. *a* is the free end of a vibrating lever, to which is jointed the looper, *b*, provided at its rear end with a pin, *c*, which is pressed against the inclined stop plates, *d*, by the blade spring, *e*. This spring acts against the side of the opening in the main bed or table, *f*, of the machine, in which a smaller sheet of metal, *g*, is inserted, having a sufficient opening made therein for the needle, E, of the machine to work in. The front end of the looper, *b*, is pointed and provided with an eye near its point, against which pointed end lies one end of the spring, *e*. The lower or second thread is passed through the eyes in the looper, *b*. The object of the plates, *d*, which are made adjustable, is to guide the course of the looper in its backward and forward motions through the pin, c, in such a manner as to cause its pointed end just to clear the needle, and enter the loop of its thread, which is opened by a slight rise of the needle, and is left looped round the looper when the needle has risen clear of the cloth. The needle, on again perforating the cloth, descends between the point of the looper and the spring behind the eye, near the end of the looper, so that as the looper draws back it will leave a loop of its thread round the needle, and will drop the previous loop of needle thread round the loop of the second thread, and then moves forward to take up a fresh loop of the needle thread, and so on, the loops passing alternately round and through each other, and forming a looped chain stitch similar to those we have before referred to.

Figs. 246 and 247 represent respectively a vertical cross section and side elevation of a small apparatus for facilitating the threading of either ordinary hand-sewing needles, or the needles of sewing or embroidery machines, for which a patent was granted to John Savage, of Nottingham, on the 4th of July, 1860. It consists of a perforated plate, having grooves made in it to receive the needles of different sizes, which needles, when properly adjusted, will present their eyes in exact coincidence with the funnel-shaped perforations made through the plate, and, consequently, the thread will be guided accurately through the eye of the needle, when entered through these perforations. The inventor further proposes to make the plate in two parts, and to adjust each part, in relation to the other, in such a manner as to render them suitable for needles of different lengths.

FARM ENGINEERING—THE ROYAL AGRICULTURAL SOCIETY.

Now that farmers are looking to steam as the power, and to mechanical appliances, as the immediate means of overcoming many of the difficulties which attend high class tillage of the soil, we may very properly draw the attention of mechanical engineers to the pressing requirements of agriculturists, as detailed by the Royal Agricultural Society of England. The following is a list of prizes offered by the society, for essays and reports to be sent in on or before the 1st March next.

I. Agriculture of Staffordshire.

Fifty Sovereigns will be given for the best Report on the Agriculture of Staffordshire.

The principal geological and physical features of the county should be described; the nature of the Soil and character of the Farming in its different districts or natural divisions; its Live Stock; Implements; recent changes of Farm Management; Improvements lately introduced and still required; remarkable or characteristic Farms; the influence exercised by neighbouring mines and factories on the cropping of the soil, the value of land, the rates of prices and wages, and on the demand for timber, and consequently on the profitable management of woods and plantations.

II. Subsoiling versus Double-ploughing.

Twenty Sovereigns will be given for the best Essay on the comparative merits of Subsoiling, Trenching, and Double-ploughing.

The comparative cost of these several modes of cultivation; their influence on different crops, on the germination of seed-weeds, and the destruction of root-weeds; the supplies of manure required in each case are to be contrasted, and the most seasonable manner of conducting the work described.

III. Steam-power and Threshing-Machines.

Twenty Sovereigns will be given for the best Essay on the comparative advantages of Fixed or Moveable Steam-power, and of the Single and Double Dressing Threshing-Machine.

The cost of repairs and allowance required for depreciation in each case are to be carefully examined; the labour and waste incidental to threshing in the field and in the barn; and the applicability of the steam-power to other purposes should be contrasted; in the case of the threshing-machines, the weight of the machine and the requirements of the market in respect of samples should be considered.

IV. Haymaking.

Ten Sovereigns will be given for the best Essay on Recent Improvements in Haymaking.

V.

Ten Sovereigns will be given for the best Essay on any other Agricultural Subject;

And an additional list has been approved, papers for which competition are to be sent in by the 1st of May.

Thirty Sovereigns will be given for the best Essay on the Parisites, including Entozoa, which infest cattle and sheep.

Tweuty Sovereigns will be given for the best Essay on Land Valuing.

The estimates which ought to form the basis of calculation in fixing the rental of land; the seasons most favourable for inspection; the practicability of reducing lands under different systems of culture to the same standard of calculation should be discussed.

3. Ten Sovereigns will be given for the best Essay on the Management of a Home Farm or Farm attached to the residence of a landed proprietor. The arrangements in the dairy and stable, the proper rates of charge for farm produce or services supplied, and the advantages and drawbacks of such a connection are to be discussed.

4. Ten Sovereigns will be given for the best Essay on the Ravages of Grub and Slug on the Wheat plant.,

The predisposing causes from weather, or situation, or cropping, and the best modes of prevention or cure are to be stated.

Contributors of Papers are requested to retain copies of their communications, as the Society cannot be responsible for their return.

The successful competitor for the Prize of £50, offered by the Right Hon. the Earl of Powis, for the best Essay on the Improvement in the Farming of Yorkshire, was Mr W. Wright, of Sigglesthorne Hall, Holderness.

The Society's Prizes have been awarded as follows:

Class II. To the Rev. J. Wilkinson, Broughton Gifford Rectory, for the best Report on the Agriculture of Hampshire	£50
Class VI To Mr Thos. Bowick, Stoneleigh Abbey Farm, Warwickshire, for the best Essay on the Rearing of Calves ...	£10
Class VII. To Mr Peter Love, of Northampton, for the best Essay on Harvesting Corn	£10
Class VIII. To the late Mr Charles Wratislaw, of Woolscot, Rugby, for the best Essay on Farm Capital	£10

We shall be glad to hear that more mechanical men will now give attention to the wide field of agriculture, in the application of their craft.

RECENT PATENTS.

FLYERS FOR SPINNING.

James Dunn, *Preston.—Patent dated April 5*, 1861.

The improvements described in the specification of these Letters Patent have reference to an arrangement and construction of "flyers" applicable to the slubbing, roving, spinning, and doubling of cotton, and other fibrous materials, whereby two twists can be given to the material under treatment at every single revolution of the flyer, and the entire operation of twisting is effected in a more speedy and efficient manner than heretofore.

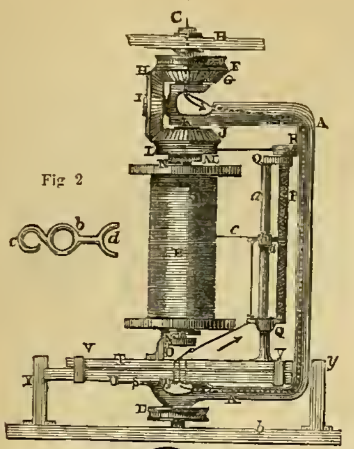


Fig. 1.

Fig 2

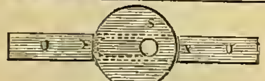


Fig 3.

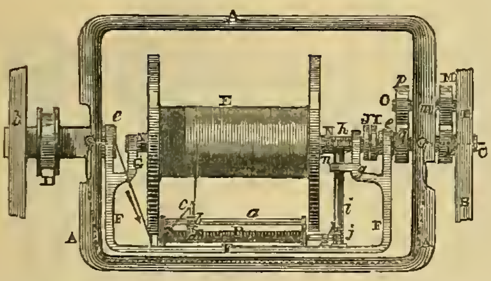


Fig. 4

Fig. 1 of the subjoined engravings is a side elevation of one modification of this improved apparatus, as arranged for vertical spindles and flyers; fig. 2, a plan of the traverser detached. Fig. 3 is a plan of the reciprocating plate, and eccentric for actuating the same; and fig. 4 is a side elevation of the second modification of this apparatus, arranged for horizontal spindles and flyers. A, fig. 1 represents the flyer mounted in bearings, B, *b*; the neck of the flyer passes through the bearing, B, and receives the thread at C, the course of which is shown by the dotted line. The flyer, A, is driven by the pulley, D, fixed upon the foot of the flyer. E, is the bobbin to which a winding-on motion is imparted through the pulley, F, mounted loosely upon the neck of the flyer. Attached to this pulley is a small mitre wheel, G, which also works loosely upon the neck of the flyer, and drives another mitre wheel, H, carried loosely upon a short arm or stud of the flyer at I. This latter drives a third mitre wheel, mounted loosely upon an internal stud in the flyer at K. The last wheel has attached to it a wharve or pulley, L, having upon it a hollow boss or neck, M, for the convenience of holding in its place the spindle, N, carrying the bobbin, E, the foot of the spindle being mounted in the footstep bearing, O. The pulley, F, is driven by a band actuated by the cone drum apparatus of the ordinary roving frame; hence it is obvious that the motion of the bobbin, E, which is connected by a lug to the boss, M, may be graduated to the requirements of its increasing diameter. The thread is made to traverse from end to end of the bobbin by means of a right and left hand screw, P, mounted in bearings, Q, and carrying a small pulley, R, driven by a band from the pulley, L *a*, is a round rod upon which is fitted loosely the "traverser," *b*, shown at fig. 2, detached. This traverser guides the thread to the bobbin, E, and is formed by a ring, *b*, loosely encircling the upright rod, *a*. This ring, *b*, has projecting from it on one side a hook or guide-eye, *c*, for conveying the thread to the bobbin, and on the other side a fork or clip, *d*, fitted into the thread of, and half-encircling the right and left hand, or double reverse threaded screw, P, the rotation of which imparts a reciprocating motion to the traverser, *b c d*, which is alternately acted upon, at each traverse, by the right and left thread of the screw, and consequently moves up and down, so as to guide the thread evenly on to the bobbin, E, along its entire length. It will be seen that the bobbin, E, requires only motion sufficient to enable it to wind on the thread as fast as it is given out by the front rollers; unless prevented, however, the apparatus would carry the bobbin round at the same speed as the flyer, A. To prevent this, the following contrivance is adopted: The bearing, O, carrying the spindle and bobbin, also the bearings, Q, carrying the screw spindle, P, are mounted upon a kind of double platform, T, U; the upper part, T, of which is intended to remain stationary, whilst the lower part, U, is held to the upper part by means of the guides, V, and is made to keep the upper part in a stationary position as follows: The part, U, rests upon the foot of the flyer at W. This foot is formed by an eccentric disc, S, a plan of which is shown at fig. 3. Upon motion being given to the flyer, A, the disc, S, working against the sides of the recess or lugs, X, fig. 3, formed in the bar, U, imparts an alternating lateral motion to it, thus causing it to slide towards and catch the small pillar, Y, when the leg of the flyer, A, is at the opposite side, or the pillar, *y*; then, when the leg of the flyer, A, is at the side or pillar, Y, the bar, U, catches in the pillar, *y*, so that in this manner the platform, with its mountings, is kept locked and prevented from revolving with the flyer. In the modification of a horizontal arrangement, shown at fig. 4, A, is the flyer, carried on bearings, B, *b*, and driven by the pulley, D. E, is the bobbin, mounted and driven as follows: From inner projections or bosses, *e*, at each end of the flyer, is suspended loosely a framework, F, provided with the arms, O, *g*, which carry the spindle, N, upon which is mounted the bobbin, E. Motion is given to the spindle, N, and through it to the bobbin, E, which is mounted rather tightly upon the spindle, N, as follows: The part, *e*, projecting inside from the end, C, of the flyer, A, where the thread or yarn enters, carries a friction disc, I, working in contact with another friction disc, J, carried on the end of the spindle, N, of the bobbin which is thus driven. The spindle, N, is jointed at *n*, for the purpose of putting on and taking off the bobbins; and these being held by the thread are prevented from revolving faster than is sufficient to take up the thread as it is given out by the front roller, slips to the necessary extent at the friction discs of I and J, without straining the thread. The thread is made to traverse from end to end of the bobbin by means of the reverse threaded or right and left hand screw, P, working a traverser or guide, *b c d*, as described in reference to figs. 1 and 2; the screw in the present instance being driven in a rather different manner from the spindle, N, by means of a worm cut upon it at *h*, and driving a small worm wheel fast on the top of the small upright shaft, *i*, upon the foot of which is a worm at *j*, driving a worm wheel, *k*, on the end of the screw spindle, P, the traverser carried by a horizontal rod, *a*, mounted close to and over the screw, P, as hereinbefore described in reference to the first modification. In order to lessen the tendency of the suspended framework, F, to oscillate in this horizontal arrangement, the following contrivance is adopted: At the bearing, B, is a boss or projection, L, forming part of the bearing. This boss serves as a *stationary* friction pulley round which and in contact with it works another friction pulley, M, mounted in the shoulder of the flyer at *m* The pulley, M, is fast upon the short shaft, O, which at its other end carries another friction pulley, *p*. It will be seen that the two pulleys, M and *p*, have two motions, viz., one round the axis of the flyer, A, and another round their own axis, O; and as the pulley, *p*, is in contact with a fourth pulley, *q*, it will be obvious that this last will remain stationary so as to form a stationary point of suspense to the framework, F, which in this way is made to hang more steadily than might otherwise be the case. It will also be obvious, the motion of the spindle, N, may be regulated positively, instead of by the friction discs, I, J, simply by detaching the stationary friction pulley, L, from the bearing, B, and giving motion to it by means of a band or otherwise, as in fig. 1. It will thus be seen that in both modifications a first twist is imparted to the thread upon its first entering the neck of the flyer, and that it receives a second twist upon its leaving the flyer at the foot thereof; so that this apparatus would accomplish twice the production, per spindle, of an ordinary mule or throstle driven at the same speed. The drag being extremely delicate, the apparatus can be applied to roving and slubbing, as well as to the finest counts. The peculiar shape of the flyer enables it to be driven at any speed practicable. A spinning machine, mounted with this apparatus, would be of the simplest possible construction, as no internal driving gear is required.

PRESSURE GAUGES.

Paul Cameron, *Glasgow.—Patent dated May* 31, 1861.

In the specification of these Letters Patent, Mr Cameron has described the arrangement and construction of apparatus suitable for registering or indicating the pressure of steam, as well as that of the atmosphere, gas, or water. Under certain modifications, the instrument is also applicable as a means of regulating the pressure and flow of fluids, so as to cause them to flow in a regular and uniform manner, or to give an audible or visible signal upon a given or predetermined pressure being exceeded.

Fig. 1 is a front external elevation of one arrangement of a steam gauge, constructed according to these arrangements; and fig. 2 is a vertical section of the same gauge, taken at right angles to fig. 1. The mechanism of the gauge delineated in the subjoined figs. 1 and 2, is contained in a circular, or other shaped box, A, to the lower part of which is attached the cock, B, which is connected to a steam pipe at C, by a coupling joint, in the usual manner. This steam-pipe being in communication with the boiler, conveys the steam up through the tubular passage of the cock, B, to the tube, D, which is arranged within the gauge box, A. To the back of the box, A, is attached the metal plate, E, and to the face of this plate is screwed a brass ring, F, which is more clearly shown in the section, fig. 2. The face of the ring, F, is made with an annular groove, in which is fitted the ring, G: before screwing down the ring, G, a leather washer is put in the annular recess of the part, F, and upon this washer is placed a film or disc of mica, H; a second washer or ring of leather is put on the mica, and the ring, G, is screwed down; the arrangement now forms a steam-tight chamber, into which the steam pipe, D, opens. It follows, from the construction

Fig. 1.

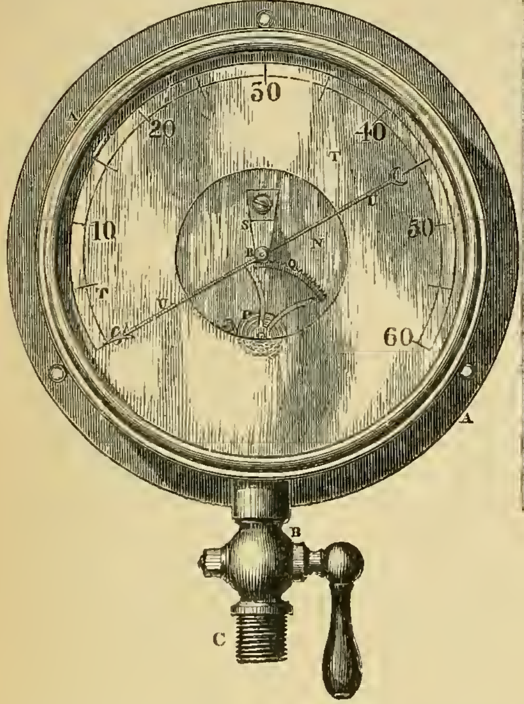
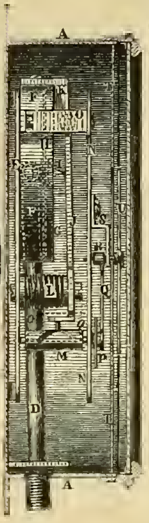
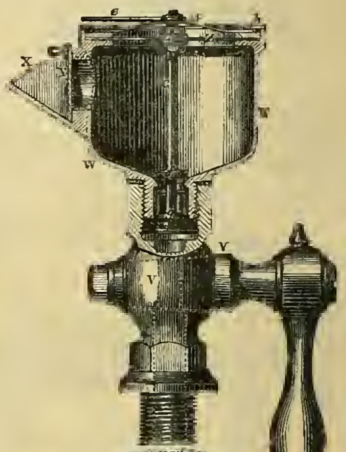


Fig. 2.



of this part of the apparatus, that when steam or other similar elastic fluid is admitted to the chamber formed by the ring, F, and the parts connected thereto, that its pressure acting upon the film of mica, H, will cause it to bulge outwards, more or less. If, therefore, the film be connected to suitable indicating mechanism, this varying motion will correctly indicate the pressure on the dial plate. To the centre of the disc of mica, H, is attached, by means of a nut, the stud piece, I, the outer part of which is shaped to a wedge-like figure, as shown in profile in fig. 2. The edge of the stud-piece, I, is in contact with the lever, J, which is jointed at one end to the elbow piece, K, so that the lever is free to move up and down with the motion of the mica disc, H. Near the lower end, the lever, J, is connected to the helical spring, L, by means of which the lever is brought back to the normal position, when the pressure on the disc is removed. The extremity of the lever, J, is bent inwards towards the back of the box, A, and this part carries a downwardly projecting pin, which takes into a curved slot which is formed in the hollow cylinder, M. The journals of this cylinder are carried in the plates, E and N, the latter of which is supported on bracket pieces, O, screwed to the back plate, E, the lower one which is indicated by dotted lines being removed to show the cylinder, M. The front part of the spindle of the cylinder, M, carries the fine spiral spring, P, and also the segmental rack, Q, which gears with the pinion, R. The spindle of the pinion, R, is carried in the front plate, N, and in the overhanging bracket-piece, S, the extremity of the spindle projects out through the graduated dial plate, T, and has attached to it the index or pointer, U. A circular opening is left, in the centre of the dial plate, T, which shows a portion of the internal mechanism, as delineated in fig. 1 of the accompanying engravings. Upon admitting steam or other similar elastic fluid to the chamber, F, its pressure upon the mica, H, causes the lever, J, to be moved outwards; and this motion is communicated through the cylinder, M, to the pointer, U, and in this manner the pressure of the steam is accurately indicated on the graduated plate, T. The front part of the box, A, is enclosed by means of a plate of glass, in the ordinary manner. The helical spring, L, shown in fig. 1, is not of the same diameter throughout, but is preferred (in most cases) to be made of a conical figure, the smaller part being in front next the lever, J. This arrangement admits of a kind of differential compensation for the range of movement of the lever, J, so that when the mica is acted upon by high pressures, the spring acts with a uniform resistance, in place of the resistance gradually increasing, as the lever, J, is moved outwards. In arranging this apparatus, as a vacuum gauge, the same general arrangement of the parts is observed, the pipe, O, is connected with the vacuum chamber to be indicated. In this way, the pressure of the external atmosphere upon the disc of mica causes it to be pressed inwards, the concavity of the disc being proportioned to the amount of vacuum obtained in the chamber formed by the ring, F, and its connected parts. The motion of the mica disc is imparted through a pulling link, instead of the pushing stud, I, and lever, J, to the cylinder, M, and thence to the pointer, U, the index plate, T, being suitably graduated for the purpose. The apparatus is also equally adapted for indicating the diurnal variations of the atmospheric pressure. For this purpose, the chamber formed within the ring, F, is completely sealed, and is carefully exhausted of air, so that as the atmosphere presses with more or less force upon the surface of the mica, it is more or less depressed, and the pointer indicates the same upon a dial plate, graduated to correspond practically with the inches of the ordinary mercurial column. A barometer, formed upon this principle, may be constructed to be as sensitive as the best examples of the Aneroid form, but having great advantages over those instruments, as being much less liable to injury, either in travelling, or when otherwise exposed to rough usage. So also in the steam or vacuum gauges, there are corresponding advantages; the mica is a non-oxidisable material, and it is not liable to injury from any amount of reciprocatory motion imparted to it. The gauge, from the simplicity of its construction, is readily taken asunder and re-adjusted by any ordinary mechanic, should any derangement, from an extraordinary or unforeseen cause, arise. This invention is also applied to a lubricator, for the purpose of lubricating the interior of a steam cylinder — a sectional elevation and plan of one modification of which is delineated in figs. 3 and 4 of the accompanying engravings. The grease cock, V, is screwed into the cylinder cover, or other part in the usual way, and to this is attached the grease cup, W, which is supplied from time to time with oil or grease that is poured into the hopper feed, X. The aperture which opens into the cup, W, from the hopper, is closed by a vertical slide, Y, when the cup is properly supplied. The upper part of the lubricator is fitted with a mica disc, Z, in manner similar to the corresponding part in the steam gauge hereinbefore described. Extending across the disc, Z, is a blade spring, *a*, the ends of which are passed into lateral slots formed below the face of graduated ring, *b*. The valve spindle, *c*, passes up through the disc, Z, to which it is connected by the double nuts, *d*; the upper extremity of the spindle projects out above the spring, *a*, and carries on its screwed end the pointer, *e*. By turning this pointer round, the spring, *a*, is depressed, and a greater amount of force is required to raise the disc, Z, so that the engineer regulates its position according to the pressure required. At the lower part of the spindle, *c*, are arranged the duplex valves, *f* and *g*, the seats of which are formed on the tubular part of the cup, W. When the steam is admitted to the cylinder, the cock, V, being open, its pressure on the valve, *g*, shuts the tubular passage; the grease now flows below the valve, *f*, and fills the space between the valves. Upon the steam being exhausted, the valve, *g*, opens, and the valve, *f*, is closed, which allows the oil contained in the tubular part to flow into and lubricate the cylinder and piston. In this way, a suitable and predetermined quantity of oil is admitted at each stroke of the engine. A modification of this apparatus may also be used for regulating and controlling the passage of steam from the safety valves of steam engines. In this arrangement, the spindle, *c*, and valves, *f* and *g*, are dispensed with, the steam from the boiler having free access to the chamber, W, presses upon the disc, Z. To a snug, or projecting part, on the ring, *b*, is jointed a lever, which extends across and beyond the ring, so as to admit of its being connected to the slide, Y. A pointer, *e*, is connected, by means of a screwed stud, to the transverse lever, so that by turning this pointer round, any required amount of pressure is exerted on the mica to prevent its rising. When, however, the pressure of the steam exceeds that of the lever, the mica is pressed upwards, which motion lifts the lever, and raises the slide, Y; this allows the steam to escape laterally into a chamber in which the safety valve is fitted. With this arrangement, the safety valve is more easily adjusted, and is operated with greater certainty and effect than by the ordinary means.

Fig. 3.



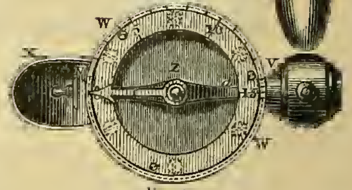


Fig. 4.

CHURNS.

James Comrie, *Stirling.—Patent dated June* 21, 1861.

Mr Comrie has, under this invention, produced a form of churn which is convenient and easily wrought.

Fig. 1

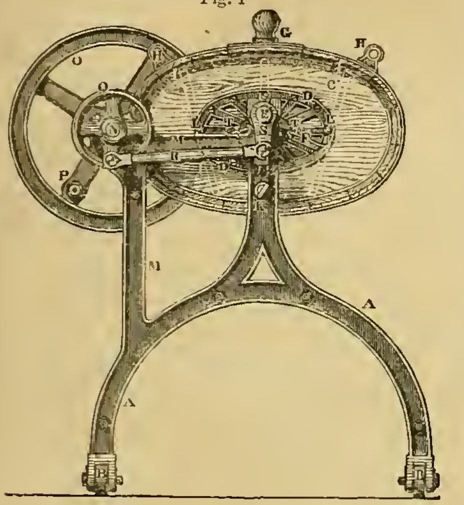


Fig. 2.

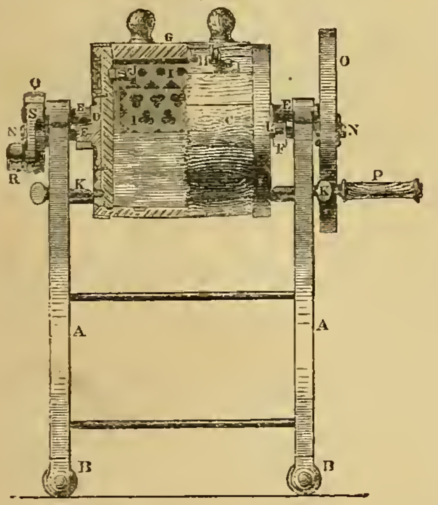


Fig. 1 of the accompanying engravings is an end elevation, showing two modifications of the patentee's improvements; and fig. 2 is a front or side view of the same churn taken at right angles to fig. 1—one-half of the vessel or churn being shown in longitudinal vertical section, showing the internal arrangement of the churn barrel. The framing of the improved churn consists of a pair of cast iron end standards, A, the lower parts of which are arched, as shown in fig. 1, so as to give perfect stability to the churn. These standards are connected together by means of transverse tie rods, fastened by nuts screwed on their extremities. The lower ends of the standards either rest on the ground, or, as in the case of large-sized churns, they are fitted with rollers, B, to admit of the churn being more readily moved from place to place. The churning vessel, C, is, by preference, made of an elliptical figure; the several staves which form the vessel are bound by broad iron hoops at the ends, as shown in fig. 2. To the sides of the churn, C, are screwed two discs, or supporting end plates, D, which are cast with the laterally projecting journals, E; these journals rest in the forked extremities of the standards, A. There is also a projecting part formed on the face of each disc below the journal, in which is a transverse groove made to receive the curved blade spring, F, which is fastened therein by two screws. The ends of the spring, F, pass under two studs projecting from the face of the end plates, D; and there is a thumb screw in the lower part of the plate. The uses of these studs and screws will be presently referred to. The churn, C, is made with a transverse opening, in which is fitted the lid, G, having two knobs or handles for removing and replacing it. On the upper part of the churn, and parallel with the lid. are fitted two roller handles, H, and ranged for conveniently working the churn up and down, when it is not furnished with a winch handle. Inside the churn are arranged three moveable partitions, or dashers, I, indicated by dotted lines in Fig. 1, which are, by preference, perforated, as shown in the sectional part of Fig. 2. The two end dashers are arranged at a slight angle, and the lower edges are bevelled off to fit in corresponding grooves formed in the lower part of the churn. The end dashers are passed in through the opening at the top, and are fastened in position by means of the buttons, J, or other equivalent fastenings. The central dasher, I, is made a little lower than the others; it is placed in a vertical position, and is fastened by two buttons at the sides. The milk to be churned is put into the vessel, C, the lid is closed down, and the churn is put in motion by one or both of the handles, H. The vessel is moved up and down, so as to cause the milk to be violently agitated, and at the same time to be broken up, as it were, by passing through the apertures in the dashers, I. When commencing to churn, the vessel, E, is filled about half full of milk, and during the filling operation the churn is held steadily by screwing in one or both of the thumb screws, K, which enter a short distance into holes formed in the end plates, D, of the churn, and thus serve to hold it firmly while the milk is poured in. When the churn is moved up and down by the handles, H, the vessel is prevented from turning completely over by the springs, F, coming in contact with the thumb screws, K, which then act as stops to prevent the churning vessel from passing a given point. To prevent the ends of the springs from being bent back injuriously, the studs, L, against which the springs press with the impetus given to the vessel by the weight of the milk and the hand of the operator, the reaction of the springs against the screws, K, causes the churn to rebound, as it were, and so assist the operator in causing it to descend; and, in this way, the churning is effected with a comparatively small expenditure of manual power. For the larger class of churns, preference is given to an arrangement for putting them in motion, by means of a crank and winch handle movement. This modification is also delineated in the subjoined figures. The end standards, A, have either cast on or bolted thereto a pair of secondary vertical standards, M, which form bracket pieces carrying the bearings of a transverse shaft, N. On one extremity of this horizontal shaft is fixed the fly wheel, O, which is actuated by the winch handle, P, and on the other end is a pulley, Q. Projecting from the face of this pulley is a pin which serves to connect it by means of the rod, R, with the crank, S, which is keyed on the laterally projecting part of the journal, E. The throw of the revolving crank pin in the pulley, Q, being much less than the one, S, on the spindle, E, of the churn, C, causes the latter to vibrate to and fro, the extreme positions of the crank being shown by the circles, T, in fig. 1. When the winch handle is put in motion, the pulley, Q, and rod, R, impart, by reason of the length of the respective cranks and rod, a pendulous or vibratory motion to the churn, C, similar to that given to it when actuated by hand. The larger sizes of churns arranged upon this principle may, if required, be driven by steam power, by simply fitting an endless belt to the pulley, Q, on the shaft, N, and giving motion to this belt from a contiguous engine, or other prime mover. Another mode of arranging the churn is to have the crank and connecting rod on the same side as the fly wheel. The vertical standard or bracket piece, which is bolted to the framing of the churn, forms one support for a short horizontal shaft; outside this one is a second one, which is a bracket piece bent in an outward direction, and serving as a support for the outer journal of the shaft. On this shaft is keyed the fly wheel and driving pulley, and at the inner end, between the end standard and the churn, is the crank, which is connected by a rod to a pin projecting out from the face of the disc, D. In this way, when the driving wheel is put in motion, the pendulous movement is imparted to the churn, so as to drive the milk contained therein rapidly to and fro. With either of these arrangements, the operation of churning milk is accomplished in a very rapid and efficient manner.

PORTABLE ENDLESS RAILWAYS FOR THE WHEELS OF VEHICLES.

A. Dunlop, Esq., *Glasgow.—Patent dated May* 10, 1861.

This invention relates to the arrangement and construction of endless or portable railways, or supporting surfaces, which are applicable to the wheels of vehicles of various kinds, so as to reduce their draught, and cause them to be drawn with much greater facility over rough or uneven ground than has hitherto been attained. Under one modification of these improvements, each wheel of the vehicle runs upon a series of short rails, which are jointed at the ends, so as to form a flexible band or chain as it were, surrounding the periphery of the wheel. There are by preference eight of these rails to each wheel, and each rail is, in order to obtain as much lightness as possible, combined with the requisite degree of strength, formed of wood cased with iron, or of T shaped malleable iron. Fig. 1 of the accompanying engravings is an external side or longitudinal elevation of the detached wheel of a waggon, cart, or other vehicle, as fitted with one modification of endless or portable railways or supporting surfaces for the wheel to work upon in its revolution, instead of upon the direct surface of the natural roadway. In one particular position of the rail's movement, the rails, by preference eight in number, represent or form a square figure surrounding the wheel's periphery, or in what may be called the zero position. just prior to the bending forward of the first joint, for the time being, of the rails, that joint being in a horizontal position with the axle of the wheel. In this position of the parts, the axle is exactly over the joint of the two rails lying on the ground for the time being, and the periphery of the wheel also bearing or rolling over the same joint, these two lower rails being supported at this time by three adjustable chairs. But in this view, the wheel, with its rails and their links and chairs, are all shown in a different position, the wheel being in the centre of one length

Fig. 1

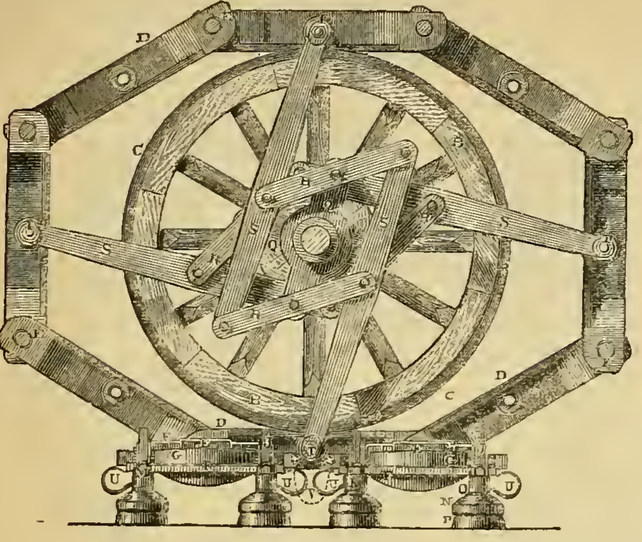
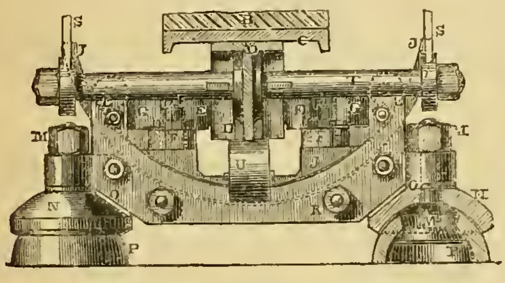


Fig 2



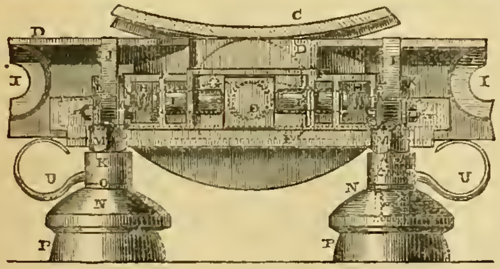


Fig. 3.

or link of the rail, which is supported by two of the adjustable chairs, which are all that are shown, the others being left out to show the chain of rails more clearly. Four only of the rods and links for keeping the rails in position are here shown for the same reason, namely, those attached to the horizontal and vertical rails. Fig. 2 is an enlarged and partially sectional end elevation of one of the adjustable chairs, showing the rail, wheel, and adjusting movement, and fig. 3 is a side elevation of the same, corresponding to fig 2. According to the arrangement as delineated in the accompanying engravings, the axle, A, has keyed to it a strong wooden wheel, B, the periphery of which is fitted with a flanged metal tyre, C. In this modification of these improvements, each wheel of the vehicle is carried upon an axle supported from a double framing. The tyre of each wheel rests upon one of a series of rails, D, which are jointed together so as to form an endless flexible band surrounding the wheel, the motion of which causes these rails to be brought in succession beneath the wheel. Each of the rails, D, is of a T shaped figure at the central part, as shown in vertical section in fig. 2. The ends of each rail, D, are forked to form a good strong joint, one extremity being made with two projecting ends, and the other with three, the extremities of these parts being tapered off to admit of a certain amount of lateral motion or play at the joints of the rails. A circular aperture is made through the forked ends of the rails, and this aperture is tapered or widened outwards, showing an oval hole at all the joints, E, in fig. 1, and by the dotted lines in figures 3, to admit of the lateral play of the axle, E, which passes through the rails and serves also as an attachment for the chairs and foot pieces. The ends of the axle, E, beyond the central round part forming the pin of the joint, are squared, and these ends pass through slots or rectangular openings formed in a pair of short beams or side frames, F, the construction of which is best seen in fig. 3. The ends of the axle, E, pass through these frames, F, and there is riveted or otherwise attached to them the blade springs, G, which give way when the axle, E, is from any cause forced endwise from its central position, and it is restored when the pressure is removed. The slots in the side frames, F, are made of sufficient length to admit also of the axle, E, having a considerable extent of motion in its lateral direction. When not otherwise acted upon, the ends of the axle are kept in a central position by means of the helical springs, H, which extend from the inner part of the side frame, F, into the tubular boxes, I. These boxes are fitted to slide to and fro in openings formed in the partitions of the frame, F, and their ends press against the sides of the axle, E. In this way, when the axle is removed from its central position, arising from obstacles or inequalities in the road, the arrangement of the springs restore the axle to its normal position when the obstacle is passed. The ends of the parallel frames or beams, F, are passed over, and within certain limits are moveable about the pivots, J, projecting up from a pair of curved or segmentally shaped plates, J, which are supported in the frames formed by the front and end plates, K. These plates are made duplex, and are bolted together, having a segmental piece bolted between them, on which the segmental plates, J, rest, the intervening piece being curved to a corresponding figure. The duplex plates, K, extend upwards at each end above the curved parts of the plates, J, and at this part is fitted a stud carrying an antifriction roller, L, which rotates against the inner and upper surface of the curved plate, J, and serves to facilitate the motion of this part of the chair and of the feet. The curved pieces bolted between the frame plates, K, extend out beyond the frame plates, where an eye is formed, through which a bolt, M, is passed; this bolt serves to connect the socket piece, N, to the projecting part. A piece of india rubber or other suitable material, O, is interposed between the socket piece, N, and the projecting part, the orifice in the socket piece, as well as the bolt, M, at that part, being squared so as to connect the parts firmly together. The lower part of the bolt, M, forms a large convex head, which supports the adjustable foot, P, in such manner that it moves freely in any direction within certain limits. This freedom of motion is obtained by making a circular opening in the upper part of the foot, so that it moves easily about the bolt, M, the contiguous surfaces being also made smooth, and corresponding accurately in figure. The advantages arising from these adjustable chains and feet are, firstly, the feet and ends of the plates, K, to which they are attached in the manner described, adjust themselves to any ordinary inequality in the roadway. Upon this occurring, the feet adjust themselves by moving in the socket pieces, and the plates, K, move up or down, so as not to alter the level of the side beams, F, or the rail itself in the transverse direction. The rail is therefore left free, and corresponds with the level of the tyre, or, in other words, with the level of the axle lengthwise. Secondly, while the feet and their connected parts thus adjust themselves to the inequalities of the road, they also modify the effect on the level of the rails in the direction of their length. For example, if one side of one foot rests upon a stone two inches higher than the roadway, the end of the plates, K, which rest on the said foot, would only be elevated one inch, and at halfway between the end of the plates would only be raised half an inch. So that the plate, J, and the ends of the short beams, F, which, in turn, rest on it, would be elevated half an inch, and, midway between the ends of the beams, where the axle, E, passes through, would only be elevated one quarter of an inch. But more than this, and what would be of more ordinary occurrence on an ordinary roadway, if one foot rests above the average level of the roadway, and another foot connected with the same joint below the level, one would compensate the other, and it would only be the difference between the height of the one, and the depression of the other, modified as before, that would effect the level of the rails in the direction of their length. Thus the rails, as they are successively laid down in front of the wheels, afford a smooth and nearly level surface for the wheels to roll upon. The feet also rest steadily upon the road, and do grind it away as with ordinary wheels. In this modification of the invention, the wheel, B, is shown carried on a short axle, A, the journals of which rotate in axle-boxes fitted in a double frame of the carriage. This mode is preferred for single or compound vehicles adapted for heavy loads, and to facilitate the turning round of the vehicle when required. The nave of the wheel is by preference formed as shown in fig. 1, forming a large eye or centre, the parts extending beyond the spokes being bound by iron rings. A small shoulder is formed on the axle in front of each eye, and a series of rings, Q, each having two laterally projecting parts, are here placed. These rings, Q, which serve as the primary connecting parts for connecting the rails, D, in pairs, correspond to the number of pairs of rails used, which, in the example given, is four. There are, consequently, four of these ring pieces, Q, arranged on each side of the wheel, and they are free to move round the axle, independently of one another, and the arms or bars are therefore free to approach or recede from each other, as the different positions of the rails may require. To each end and on each side of the ring pieces, Q, is jointed at the centre a link, R, the ends of which are jointed to the connecting bars or rods, S, which are connected to the cross rods, T. These rods pass through the oval holes in the centres of the rails, and each pair of rails are connected in like manner on both sides of the wheel, B. So that, as the rails are brought down to the ground in succession, each pair moves exactly in unison. In the first position described, the rails, D, assume the figure or position of a square, when the wheel is passing over the junction of two rails, and, in this position, the central part or joint of the upper pair of rails rests upon the periphery of the wheel. In fig. 1, the rails, D, are shown in the position they assume when the wheel, B, has progressed to the centre of one of the rails, and four only of the rails are shown coupled and connected by the links and levers, R and S, to the ring pieces, Q. This is done in order to avoid complexity, and to show more clearly the simple mode of coupling the rails. To prevent the adjustable chairs from falling forward with a sudden blow as the rails move over the upper part of the wheel, as well as to sustain them in a fair position as they approach the ground, a curved spring, U, is fitted in the segmental plates, J. These springs are in contact with the undersides of the rails, and thus prevent the chairs from falling over too suddenly, at the same time they yield when any extra pressure is exerted upon the parts. This object of preventing concussion may also be obtained by forming an eye at each end of the side frames, F, and connecting the several frames to each other by means of chains or other suitable flexible materials. This mode of connecting the side frames by means of chains is indicated by the dotted lines at V, in fig. 1, of the accompanying engravings. The forked ends of the rails, D, are tapered off towards the ends; the object of this is to allow for the lateral deviation of the rails when the vehicle is caused to turn, and so avoid the twisting or wrenching of the rail which, for the time being, is held firmly on the ground by the weight of the wheel. This system of endless rails may also be readily adapted to wheels running loosely upon their axles, in which case the boss or the bushes of the wheel is extended on each side in a lateral direction to admit of the ring pieces, Q, being fitted around them. Where vehicles arranged with these endless rails are required to traverse over soft ground, in order to prevent the feet from sinking therein, a disc or square piece of wood is fitted to each foot. In this case, the feet, P, are made with flanges to admit of the attachment thereto of the wooden sole pieces, either by means of screws or bolts. When the feet are arranged in this way, the large surface they cover prevents them from sinking into the soft ground, and, if the vehicle is required for an ordinary hard road, the wooden sole pieces are readily removed. Instead of arranging the adjustable chairs in the manner shown, they may be modified in various ways, and formed of a smaller number of parts, so as to be less expensive in the manufacture. Such modifications, whilst they serve to keep the rail in the required level position, or nearly so, nevertheless do not possess all the advantages which the more complete arrangement herein described has.

SNUFF MILLS.

William Fleming, *Edinburgh.—Patent dated June* 18, 1861.

The ordinary snuff mill consists of a grooved cylinder or tub, in the centre of which is arranged a vertical shaft working in footstep and collar bearings. This shaft carries, in radial adjustable bearings, three cast iron rollers having fixed malleable iron spindles, which work in the footstep and collar bearings. With this arrangement, the rotation of the rollers rapidly wears away the brasses, and, consequently, there is a considerable loss of efficiency and time, as well as a direct injury to the snuff, arising from the heating of the metals by the friction. The rollers of the snuff mill constructed according to these improvements do not heat during the working; they are always properly lubricated, and kept up to the surface of the grooved cylinder. Fig. 1 of the accompanying engravings is an elevation of a portion of a snuff mill, showing the patentee's improvements applied thereto. Fig. 2 is a vertical section of one of the grinding rollers to a larger scale. Fig. 3 is a transverse section of the same roller, taken on the line, 1-1, fig. 2. Referring to fig. 1, the mill consists of a central vertical shaft, A, driven by bevel gearing in any convenient manner. To the upper part of this shaft is fitted three radial arms, which are furnished with screws and nuts to admit of the attachment thereto of the slotted arms, B, the outer extremities of which are fitted with brasses, and form the collar bearings of the rollers. By means of the slots in the arms, B, and the screws and nuts, each arm may be adjusted so as to regulate, with great nicety, the angular position of the rollers, in relation to the "tub" or vessel in which the tobacco is ground. Internal screws are formed at the lower part of the shaft, A, in which are fitted the screwed footstep bearing pieces, C. When these radial bearing pieces are adjusted in position, they are screwed up tight by the jam nuts, D. The spindles of the improved rollers, in place of turning in their bearings in the usual way, are fixed, and the rollers revolve upon them. The spindle, E, of each roller is a cylindrical rod of malleable iron, with four grooves at each end, as shown by dotted lines in fig. 2. The roller, F, is formed of cast iron, and is turned externally to the figure shown in the engravings. A tubular aperture is formed throughout the roller, and the upper and lower ends are bored to receive the two deep tubular brasses, G, each of which is formed with a feather longitudinally, as shown in fig. 3. Beyond each of these brasses, the roller is turned to receive the flanged washers, H; the spindle is passed through the roller, and a metal washer, I, interposed at each end, between the washers, H, and the faces of the bearing pieces, B and C. Internal screws are formed in the upper and lower bearing of pieces, B and C, to receive the screws, J, the ends of which pass into two of the grooves formed in each end of the spindle, E, and thus prevent it from turning with the motion of the roller, F. At the upper part of the spindle is fitted a small oil cup, K, in the lower part of which is fitted some cotton wick, L, to admit of the oil percolating through it to lubricate the brasses. The oil thus supplied flows down the two grooves, at the upper end of the spindle which extends further down than those into which the screws, J, are inserted, as shown in front at fig. 2, and between the surface of the spindle, E, and the brasses, G. From this part, the oil gradually finds its way downwards to the lower brasses, which are thus constantly and effectively lubricated. In this way, whilst the spindle remains stationary in the bearing pieces, B and C, the roller turns freely upon its axis, continuously receiving a due supply of lubricating fluid, which cannot be dried up by the snuff, which, from the nature of the arrangement of the several parts, cannot have access to it. In this way, the heating of the rollers is avoided, which, in the ordinary arrangement, is a serious defect, as it tends to injure the flavour of the snuff. Another advantage is the saving of an important item of expense in the wear, and of brasses in the bearing pieces, B and C, which, in the improved arrangement, are altogether dispensed with.

Fig. 1.

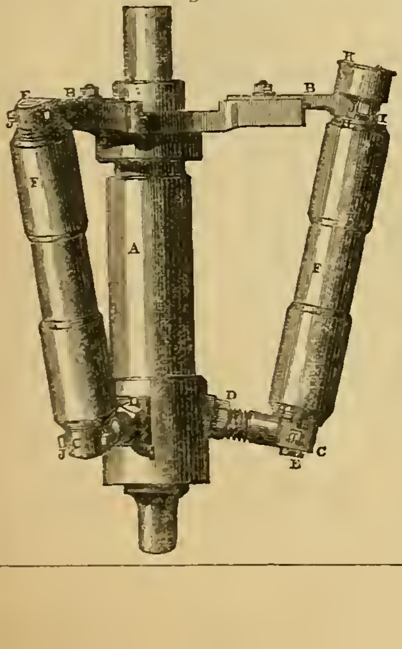
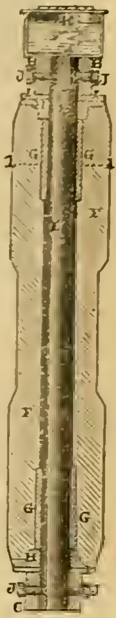


Fig 2.



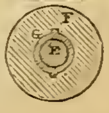


Fig. 3.

BREECH-LOADING FIRE-ARMS.

Ebenezer Erskine Scott, *Dundee.—Patent dated March* 16, 1861.

This invention relates to improvements in breech-loading fire-arms, and is more particularly applicable to rifled and other small arms, and has for its object, by simple means, to combine increased facility in loading, with security against the escape of any portion of the gases generated by the combustion of the powder otherwise than at the muzzle of the arm; and also to prevent the arm being accidentally or otherwise discharged when its several parts are not relatively in a suitable or safe position.

Fig. 1 of the accompanying engravings represents a sectional elevation of so much of a gun or musket as is necessary to show the mode of application of these new arrangements; and fig. 2 is a transverse section of the same. A portion of the inner end of the barrel of a gun or musket is represented at A, having screwed upon it the collar, B, recessed, as shown, to receive the breech-piece, C. The collar, B, (an end view of which is shown in fig. 2) is let into and firmly secured to the stock, D, by screws, for the purpose of receiving the recoil consequent upon

Fig. 1.

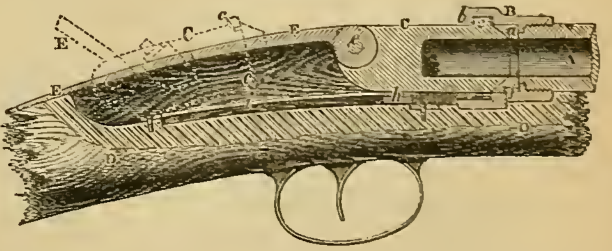


Fig. 2.

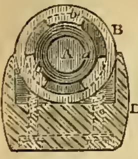
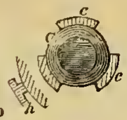


Fig. 3.



firing, and is formed with the helicoidal inclines or cam lugs, *b*, placed at intervals around its circumference; and the breech-piece, C, which carries the nipple and receives the charge, is provided with a like number of corresponding inclines, *c*, situated at the base of the conical part of the breech-piece, as shown in fig 3, which is an end elevation of the breech-piece detached from the stock. At the lower part of the breech piece, C, is formed a T-shaped projection, *h*, capable of sliding in a suitable groove or slot formed in a plate, *i*, let into the stock, D, of the gun. To the breech-piece, C, is jointed the tail-piece, E, which, when it is required to load, the arm is turned upward on the joint, *e*, into the position shown in dotted lines, and broken off at fig. 1; it then constitutes a lever, whereby the breech piece may be caused to partly revolve upon the line of its axis, and the cam lugs, *c*, formed with the breech-piece he thus removed out of contact with those marked *b*, formed with the collar, B, and brought opposite to the intervals or spaces between them, when the breech-piece may be drawn backward out of contact with the collar, B, into the position shown in dotted lines at fig. 1. After loading, the breech-piece is pushed forward, and its conical end is, by means of the tail piece, E, and inclines, *c*, again tightened against the corresponding conical recess, situated at the inner end of the barrel. In order to admit of adjustment to compensate for the wear of the helicoidal inclines, the conical recess into and against which the end of the breech-piece fits, instead of being formed in the end of the barrel itself, is formed in a separate collar or washer, *a*, which abuts partly against a shoulder formed in the collar, B, and partly against the inner end of the barrel, A. When the faces of the inclines have become worn so as to render adjustment necessary, the collar, *a*, must be removed and reinserted with a thin washer of metal or other material interposed between it and the face (formed by the shoulder and end of the barrel) against which it rests. A small groove, formed in the loose collar or washer, *a*, and a pin fixed in the outer collar, as shown at *f*, fig. 1, guide the former into its proper position when it is returned to its place. The act of turning the breech-piece upon its axis, as described, also removes the nipple from beneath the hammer. After loading, the breech-piece is pushed forward, so that its inclines are in advance of those of the barrel, when the act of turning the tail-piece into its former position causes the inclines of the breech piece to act upon those of the barrel in the manner of a screw, as previously described, thus drawing the external or male conical part or parts of the one firmly into contact with the corresponding part or parts of the other, and thereby forming a gas-tight joint, which, when the male conical part or parts is or are on the breech-piece, the act of firing will tend to tighten rather than otherwise.

MACHINE FOR BREAKING OR SOFTENING FIBROUS MATERIALS.

By Messrs Pearce and Neish, *Lily Bank Foundry, Dundee.*

Illustrated by Plate, 283.

The machine which we have illustrated in plate 283, is the invention of Mr James Robb, of Dundee, and is manufactured by Messrs Pearce and Neish, of Lilybank Foundry, in the same place. The very extensive use which is now made of Jute and Hemp, in the weaving of heavy goods, has called for powerful machinery to effect the softening of large quantities of fibre in a rapid and efficient manner. The machine delineated in the accompanying plate, is one of the latest examples in this class of machinery, and is one which in practice has given great satisfaction. From the peculiar arrangement of the rollers, a combined rubbing and slipping action is obtained, which is found to be particularly advantageous in the preliminary treatment of the fibres.

Fig. 1, of our plate 283, is a vertical elevation, partially in section of a machine suitable for softening fibrous materials, and fig. 2, is a plan (with part of the annular trough broken away) of the apparatus corresponding to fig. 1. A circular foundation, A, of timber or other suitable material, is arranged on the ground; on this foundation is fitted a cast iron or other trough, B, of a corresponding figure, the segmental portions of which are bolted together, and are firmly fastened down to the substructure. The bottom of the trough inclines downwards towards the outer part, as shown in the sectional part to the left in fig. 2, and the surface of this portion of the trough is corrugated or formed into a series of radial undulations, as delineated in the plan, fig. 2. To the overhead beams or framing, C, is attached the pendent bracket, D, which carries the bearings of the horizontal shaft, E; this shaft derives its motion from a neighbouring steam engine or other convenient prime mover. The end of the shaft, E, extends out beyond the bracket, D, and to this free extremity is keyed the bevel pinion, F, which gives motion to the large bevel wheel, G. To the transverse beams of the foundation frame, A, is bolted the cruciform foot of the central column, H, the upper end of which is fast to the overhead beams, C. To this pillar collars are fastened by means of screw bolts; between the collars the bevel wheel, G, runs loosely. To the rim and arms of this wheel are attached the brackets, I: these project outwards in a lateral direction, and carry vertical studs, which project downwards and have chains, J, attached to them by means of shackle links. The chains, J, are carried down in an angular direction, and connected to the straps, K, of the brasses which encircle the shafts, L. There are three of these shafts extending in a radial direction from the central column, H, and they are connected thereto by means of the ball-and-socket joints, M, which form part of a tubular jacket piece that revolves loosely on the central pillar; this arrangement admits of the easy movement of the shafts either in the vertical, horizontal, or rotatory directions. The jacket-piece, M, is sustained in its place on the central pillar by a collar, which is fixed in the desired position by screws. To the outer extremity of each of the shafts, L, is attached a heavy roller, N, the periphery of which is conical, and corrugated or fluted to correspond to the configuration of the trough, B. It is preferred to have the rollers, N, bevelled to a more acute angle than their true apices would afford if converging to the centre of the column, H; they are thus made larger at the inner diameter, in order to obtain a slight rubbing or slipping action, which is found to be very advantageous in operating upon fibrous materials. A quantity of the hemp, flax, jute, or other fibrous substance to be treated, either in the unmanufactured state or in the form of yarn, is placed in the trough, B, the shaft, E, is put in motion, the pinion of which drives the wheel, G, the rotatory motion of this wheel draws round the rollers, N, by means of the chains, J, the back chains serving to prevent the rollers from overrunning themselves. The corrugated surfaces of the rollers, N, press and rub the fibres of the textile materials under treatment against the fluted surface of the trough, B, and thus soften them in a very rapid and effective manner. The trough, B, and rollers, N, may, if preferred, be made smooth or plain on the rubbing surfaces, such an arrangement being useful where a less severe or rapid action of the rubbing surfaces is sufficient to accomplish the end in view. When the fibrous material has been sufficiently rolled, a fresh supply is introduced and the process is in this way carried on continuously. It is obvious that the arrangement of the rollers, N, with their ball-and-socket connections, admit of the rollers rising easily over the materials placed in the trough, so that, whilst an effective breaking and softening action is obtained, any cutting of the fibre or yarn, or other injury thereto, is at the same time avoided.

LAW REPORTS.

Plough Trade Marks: Howard *v.* Sheldon.—Assessment of Damages.—This was a writ of inquiry in the Sheriffs' Court, London, before Mr Secondary Potter, to assess damages for the fraudulent use of makers' names and trade mark, in the manufacture and sale of ploughs. The plaintiffs were Messrs James and Frederick Howard, the eminent agricultural implement manufacturers, of Bedford. The defendant was Thomas Sheldon, an ironsmith, at Ludlow, Shropshire. The declaration charged the defendant with having fraudulently used the names and trade mark of the plaintiffs on ploughs manufactured by himself. The defendant appeared to the action; but subsequently withdrew his appearance. The defendant was unrepresented. The plaintiffs' counsel stated that Messrs Howard did not ask vindictive damages, but had brought the action with a view to prevent the recurrence of similar acts of fraud, stating that should any occur, the plaintiffs would press for damages of a more serious amount. The evidence adduced proved that the defendant had made several ploughs of inferior quality, and had taking castings from a plough of Messrs Howard's, and affixed it to the spurious articles, which he had sold at a price less than that which is given for Messrs Howard's ploughs. The jury assessed damages at £5, the foreman stating, that as proceedings had been instituted chiefly as a caution to other offenders, and the defendant would be liable to costs, it was thought that amount would be sufficient. The judge certified to allow costs for the plaintiffs.

At a recent meeting of the Sheffield Chamber of Commerce, the question of the protection of trade marks against foreign piracy occupied prominent attention. The Attorney General has promised to introduce a measure early in the Session, and Mr Hindmarch, barrister, who has been commissioned to draw the bill, has just visited Sheffield for the purpose of making full inquiries on the subject. The Chamber are sanguine that a much more satisfactory measure than the one of last Session will be introduced by Government, but are prepared with a bill for introduction by Mr Roebuck if the Government measure should be unsatisfactory.

Organs: Willis *v.* Davison.—Infringement.—This was an action in the Court of Queen's Bench, before Lord Chief Justice Cockburn, and

MACHINE FOR BREAKING OR SOFTENING FIBROUS MATERIALS,

BY MESSRS PEARCE & NEISH,

ENGINEERS,

DUNDEE.

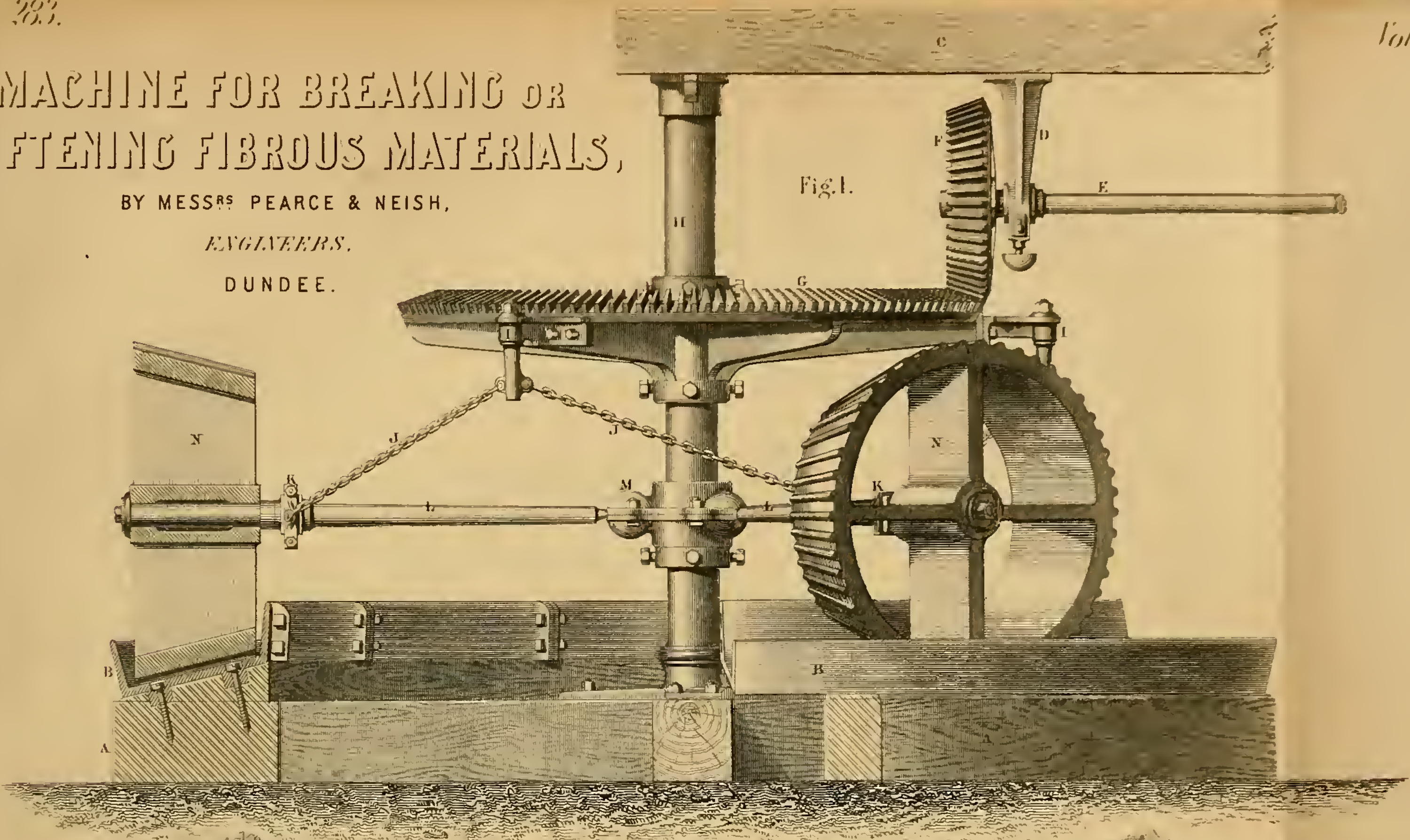


Fig.1.

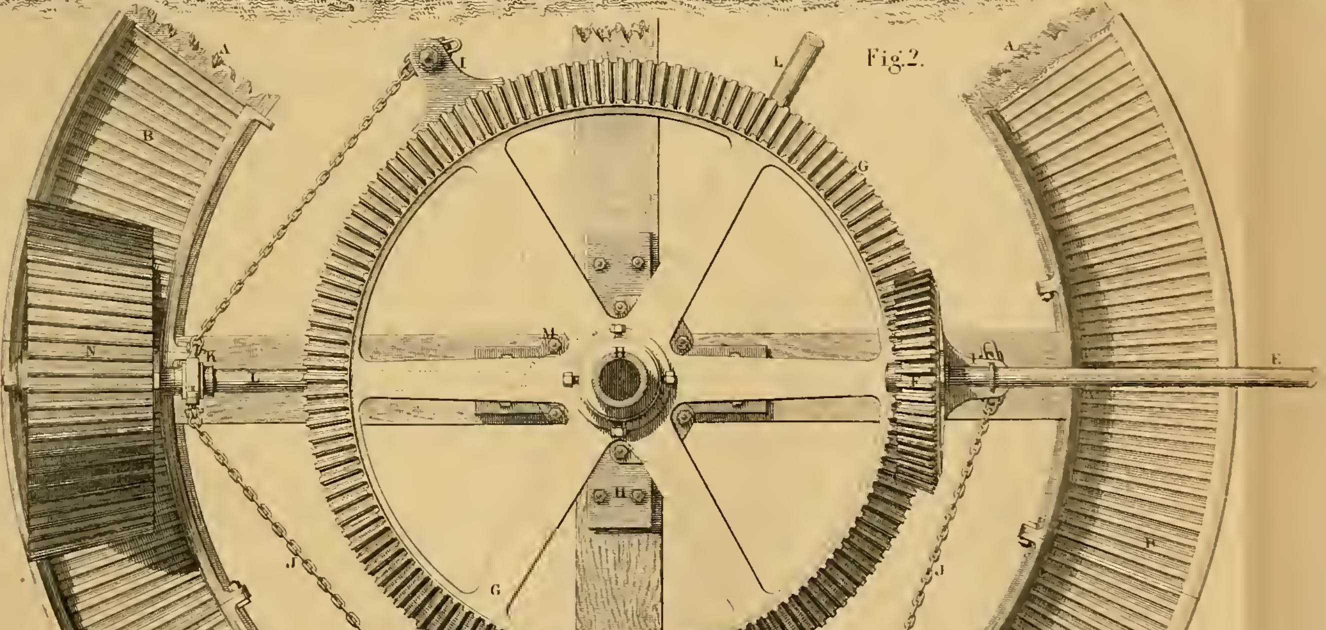


Fig.2.

—SCALE.—

INS. 12 9 6 3 0 1 2 3 4 5 FEET.

Justices Wightman, Crompton and Melloe—and it was brought against the defendant, the celebrated organ-builder, to recover damages for the infringement of the plaintiff's patent for improvements in the manufacture of organs. At the trial before the Lord Chief Justice Cockburn, at Guildhall, the verdict was entered for the plaintiff, subject to leave reserved to the defendant to move to enter the verdict in his favour.

Counsel for the defendant now moved accordingly.

The COURT granted a rule *nisi*.

GLOBE ELECTRO-MAGNETIC TELEGRAPH: WHEATSTONE *v.* WILDE.—INFRINGEMENT.—This was an action in the Court of Exchequer, before Baron Wilde and a special jury, by Professor Wheatstone, for infringing a patent of his, dated the 2d of June, 1858, for an electric magnetic telegraph, against the defendant, Mr. H. Wilde, of Manchester, for manufacturing an instrument called the globe telegraph.

The plaintiff has patented a series of inventions connected with magnetic telegraphing, and the portion of the present patent, known as the plaintiff's sixth improvement, of the infringement of which he now complains, was for arranging communicators for transmitting into a telegraphic circuit currents or shocks produced by magneto-electric or electro-magnetic machines, in continuous action, in a suitable manner to actuate a step-by-step receiving instrument included in the telegraphic circuit, each such instrument consisting of a series of finger-keys equal in number and corresponding with the letters and signs on the dial of the step-by-step receiving instrument; these keys being so arranged that, when acted on, they cause such a number of efficient currents or shocks to pass into the telegraphic circuit as is required to remove the index or pointer of the receiving instrument from the position in which it last stopped to the letter or sign corresponding with the key acted on. In the fifth improvement of the plaintiff the communicators were efficient only when the magnets were of comparatively small dimensions. In the present improvement, by certain mechanical arrangements, the armature of the permanent, or electro magnet, is kept in continuous motion by the hand of the operator, or by being connected with any moving power, and finger stops corresponding with the letters on the dial of the telegraph being respectively pressed down regulate the passage of the currents or shocks in the telegraphic circuit for the purpose of acting on the detached telegraph. By this means, however large and powerful the magnet which is employed may be, the operator may act upon the finger keys with the same facility, which would not be the case were the motion of the armature itself to be arrested thereby.

The patent was in court, fitted up in working order, the dial resting on the front of the jury box, and in the course of opening the plaintiff's case Mr. Grove operated upon the instrument, and the dial indicted "Find for the plaintiff," a message which caused a great deal of merriment.

This case was eventually adjourned till the 13th of January, the parties to have liberty to apply to the judge as to the best mode of disposing of the case. It appeared to be hopeless to try the questions involved before a jury, unless it were composed of scientific men.

TRADE MARKS—CONFECTIONERY—WOTHERSPOON *et al v.* GRAY *and al*—INTERDICT.—This case in the Scottish Court of Session, before Lord Jerviswoode, arose by a note of suspension and interdict presented by Messrs Robt. Wotherspoon & Co., of Glasgow, against Messrs John Gray & Co., Glasgow. The allegation of the complainers is, that in October, 1859, in the ordinary exercise of their trade, they invented and introduced to the public a lozenge of peculiar merit, composed exclusively of sugar upon the usual foundation of gum arabic, and manufactured by steam machinery, without manipulation of any kind whatever. The complainers gave to these lozenges the name and title of Victoria Lozenges, and they allege that the popular demand for them has been so great that they are in the habit of consuming a ton of sugar daily in their manufacture, making in value about £100 worth of lozenges. These lozenges are sold by the complainers in packets of sizes varying from one to sixteen ounces, and on the front of the paper wrapper of each packet the words "Wotherspoon's Machine-Made Cinnamon (or clove, musk, ginger, lemon, peppermint, or those as the case may be) Victoria Lozenges, free from colour," are imprinted. The side of the paper wrappers bear the words "Those lozenges, being manufactured from the finest sugar by our patent self-acting steam machinery, by which all working of the sugar by the hands is avoided, and the most perfect cleanliness is insured, are recommended as the purest confections which can be made." The complainers go on to state that the respondents, Messrs Gray & Co., taking advantage of the growing popularity of the Victoria Lozenges, have prepared imitations, and have sent these into market with the intention of their being purchased and received as the lozenges of the complainers. They allege that the respondents have imitated the style of the packets in which their lozenges are sold, in regard both to the front and the sides of the paper wrappers. On the front the respondents have "Cinnamon (or, as the case may be,) Victoria Lozenges;" and on the sides, "John Gray & Co.'s Machine-made Victoria Lozenges. These lozenges being warranted genuine in quality, manufactured by self-acting steam machinery, and free from all colouring matter, can be safely recommended as the purest comfit made." The complainers further allege that, in consequence of these proceedings of the respondents, they have sustained serious damage, and they ask interdict against them, their servants and agents, to prohibit and discharge them from selling lozenges under the style and title of Victoria Lozenges, and from imitating the other announcements made by the complainers.

Answers having been lodged for the respondents, the Lord Ordinary has pronounced the following interlocutor, which, it will be observed, refuses the prayer of the complainants:—

"The Lord Ordinary having heard counsel, and made *avizandum*, and considered the note, answers, and productions, passes the note, and refuses the interdict in *hoc statu*. CHARLES BAILLIE."

Note.—The Lord Ordinary has examined the various authorities to which he was referred in the course of the debate which took place before him, and has, with the aid thus afforded, again considered the note, answers, and productions.

The only result to which he can, with any satisfaction, arrive in the present state of his information, and of the averments of parties, is that he ought to pass the note, so that the facts may be more fully ascertained, and he would, as he thinks, run the risk of doing injustice to the respondents were he, even on caution, to grant interim interdict, for which the complainers so anxiously insist.

Having arrived at this conclusion, the Lord Ordinary thinks it expedient to refrain from now expressing any opinion on the merits of the question which remains, and which can scarcely fail to be affected by the result of such inquiry as may hereafter take place. C. B.

WEAVING: GRIMOND *v.* COX *and al*:—SUSPENSION AND INTERDICT FOR INFRINGEMENT.—This was before the Scottish Court of Session. Mr Grimond, as holder of a patent obtained in May, 1860, for an improved mode of weaving, brought a suspension and interdict against Messrs Cox for alleged infringement, and found security for any damages they may sustain if the action ultimately fails, should he obtain interim interdict. The respondents plead that the mode of weaving in question has been known and practised by them, and by others in Dundee, Glasgow, Paisley, and other places, for very many years prior to 1860, and that the patent is therefore invalid.

After the case was brought, the complainer offered to allow the interim interdict to be refused if Messrs Cox kept an account of their manufacture by the process, and found caution should the complainer ultimately succeed. But the respondents declined all such arrangements fettering their business.

The respondents farther plead that the interim interdict could not be granted, owing to want of precision in the prayer of the petition; and in the course of the debate the petitioner, on paying £3 3s. to the respondents, was allowed to amend, and amended the prayer. On the conclusion of the debate, the Lord Ordinary (Jerviswoode) made avizandum, and has since refused the interim interdict, though the note has been passed, as a matter of course, to enable the petitioner in the ordinary court to try his case. The following is Lord Jerviswood's interlocutor and note:—

Edinburgh, 12th Dec.—The Lord Ordinary having considered the note as amended, answers thereto, and whole process, and heard counsel, passes the note, but refuses the interdict *in hoc statu*

CHARLES BAILLIE.

Note—The question, whether or not interim interdict should be granted, was fully argued before the Lord Ordinary, and as it presents itself to his mind is one of considerable difficulty.

On the occasion of the first discussion, which took place before him, the respondents objected to the form of the note in terms of the first two pleas in law, and the complainer, with the view to obviate the difficulty, obtained leave to amend the prayer of the note, in terms of the interlocutor of 29th November last.

An amendment has since been made, and the debate resumed. The respondents still object to the form in which the prayer is now framed, in so far as respects the demands of the complainer for *interim* interdict, on the ground that it does not sufficiently specify the acts against which the interim interdict is to be directed.

It is evident that this objection differs in some respects, from that first taken and which was rested partly upon the provisions of the Act of Sederunt of 24th December, 1858, under which a complainer in such a case as this is bound to specify in the prayer of the Note "the specific interdict wanted, and that not by reference to the Statement of Facts annexed to the Note."

By embodying in the prayer, as now amended, the specification to which the letters patent refer, the complainer has obviated the objection so far as rested on the latter branch of the clause of the Act of Sederunt. But the question remains whether or not he has sufficiently specified the interdict which he here craves, so as to warrant the Lord Ordinary in now granting it before proof or investigation.

As respects the aspect of this particular question, it appears to the Lord Ordinary that the amendment has not affected any material change. The setting forth of the specification in no way limits the general terms of the prayer as originally framed; and if interim interdict were granted, it would follow that the respondents would be liable in breach of interdict if they did any act whatever which could on proof be shown to be struck at by the terms of the interdict.

It appears to the Lord Ordinary, however, to be his duty to be careful not to grant *interim* interdict, a breach of which the respondents might unwittingly and innocently commit, and the more he has considered the nature of the demand here made by the complainer, the more has he felt difficulty in acceding to it. He has endeavoured to discover from reported cases what has been the course adopted by the Court in such circumstances as here present themselves. But he has not been able to satisfy himself that the precise point has been made matter of decision. In the case of Knox *v.* Paterson, reported November 13, 1857, and February 20, 1858, to which he was referred on the part of the complainer, he observes from the session papers that the prayer of the note of suspension and interdict was nearly in the terms of that in the present instance, as first framed. But no objection to it appears to have been taken; and as the respondent there at once offered to keep an account, and found caution, the note was thereupon passed, and the interdict refused.

But the Lord Ordinary observes that in some other cases of alleged breach of patent, the complainer has directed the prayer of the note against certain *specified acts*, the performance of which would amount to an infringement of the patent, and not merely against any infringement of the patent as here sought.

This appears to have been the form of prayer in the case of Neilson *v.* the House-hill Coal and Iron Company, January 27, 1841, if the Lord Ordinary reads correctly the report of the case, in which, however, the terms of the interdict sought are narrated only, and not quoted; and in a case of Binny & Co. *v* Millar & Co , now in dependence in the Court, and in which issues have been adjusted, this form is adopted.

Such a form of prayer appears to the Lord Ordinary to be that which is alone truly in accordance with the Act of Sederunt which instructs a complainer to "state the specific interdict wanted."

But a prayer against a respondent "infringing or acting in contravention of letters patent," is, as the Lord Ordinary thinks, a general and not a specific prayer; and it appears to him that if a complainer, such as the party here, seeks interim interdict, he ought to seek it against the respondent doing specific acts, the doing of which, without the license of the complainer, would be a contravention of the patent.

Nor does it appear to the Lord Ordinary if the complainer has a case, that he is put to hardship by requiring this at his hands. If he is prepared to prove that the respondent has contravened his patent, he must be able to say in what manner he has done so. C. B.

Such is the position in which this case at present stands. It is most important that the specific acts of infringement should be set forth, as otherwise, it is clearly impossible for an alleged infringer to understand exactly what he is charged with.

Crinoline Fastener: *re* **Enoch Dance's Application for Patent.—Opposition.**—This was an opposition on the part of James Stevens of Birmingham, haberdasher and fancy trimming warehouseman, before the Attorney-General, to the grant of letters-patent to Enoch Dance of the firm of Abbatt and Dance, manufacturers of Bolton-le-Moors, for the alleged invention of a "a new or improved crinoline fastener," as set forth in the petition of Mr Dance, recorded on the 24th day of June, 1861. The objections filed by Mr Stevens, were that the alleged invention was not a new invention, and that Enoch Dance was not the first and true inventor thereof. The opposer clearly proved that crinoline fasteners similar to the alleged invention of Dance, were given to him by one Richardson in the month of May, 1861, and that he exhibited the fastenings publicly, and handed them to travellers for the purpose of obtaining orders for them. The travellers again proved their exhibition of the fasteners and their receipt of orders for them, prior to the 24th June, 1861, the date of the application for the patent. There was no conflict of evidence on these heads, but the petitioner's declarations alleged that Dance had communicated the invention confidentially to Richardson. After hearing Mr J. H. Johnson of Lincoln's Inn Fields, on behalf of the opposer, and Mr Brooks of Chancery Lane, on the part of the petitioner, the Attorney-General took time to consider his judgment, which he finally gave in writing, as follows:—"I allow this patent to proceed: thinking that the question of fact, whether Mr Dance or Mr Stevens invented, and the mixed question of fact and law, whether the invention had been made public before Mr Dance applied for protection, admit of too much doubt to justify a law officer in stopping the patent." W. Atherton.

The question will thereon, no doubt, come on in another shape when the defendant's patent is completed.

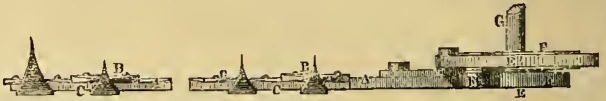
REGISTERED DESIGNS.

REAPING MACHINE.

Richard Alty, *of Pilling*, and **John Whiteside**, *of Kirkham, Lancashire, Proprietors.*

The purpose of utility to which the shape or configuration of the new parts of this design has reference, is the obtainment of a more simple and effective mode of actuating the cutter bar of reaping machines. Fig. 1, of the accompanying engravings is a front elevation showing the ordinary cutter bar, and the novel form of apparatus for imparting a reciprocatory motion thereto, and fig. 2 is a plan of the same, corresponding to fig. 1. A, is the cutter bar, provided with suitable cutters or knives, B, and working longitudinally to and fro in a grove in the fixed bar, C, to which the stationary fingers, D, are secured. The cutter bar is provided at the driving end with two arms, E, and E^1, which are in different horizontal planes, so as to be respectively acted upon by the two pairs of tappets, F, and F^1, fast on the vertical shaft, G. As this shaft revolves the tappets, F, act in rotation upon the extreme end of the arm, E, and push the cutter bar, A, forward twice at each revolution, and the tappets, F^1, act against the projection, *e*, formed on the upper arm, E^1, and bring the cutter bar, A, back twice at each revolution, thus the combined action of the several tappets on the arms, E, and E^1, causes the cutter bar to make four strokes (namely, two forward and two backward) at every revolution of the shaft, G, the usual crank and connecting rod, and the joints at each end thereof, for working the cutter bar being dispensed with.

Fig. 1.



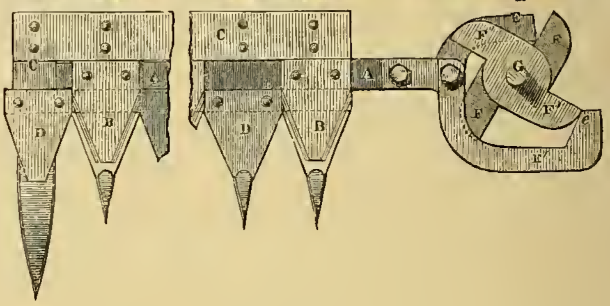


Fig. 2

REVIEWS OF NEW BOOKS.

Elementary Treatise on Physics, Experimental and Applied. By Prof. A. Ganot. Translated by E. Atkinson, Ph. D., F.C.S. Parts I., II., and III. 8vo. London: Bailliere.

In the days of Desaguliers and Helsham, when under the name of Natural and Experimental Philosophy, everything that was known of statics, dynamics, and physics, was mixed up together, and reduced to demonstration, by an appeal in a particular case to the senses, this *sort* of book would have stood *facile princeps*. At present, however, when mechanics and physics are as distinct as zoology and geography—and when the only exact or "fructiferous" knowledge of mechanism must be based throughout upon mathematics, and clearness with brevity conferred by the use of symbols, the losing sight of the distinction between physics and mechanics is a mistake, and the attempt to teach them as one, must end in a mischievous educational failure. The original work of M. Ganot, although stated to have attained its ninth edition, we must confess to having never seen. We are hence unable to determine, whether the mistakes which abound in Dr. Atkinson's translation are traceable to his original, or originate with himself. The translator, however, should clearly be competent to note, and it is his business to apply corrections to the work he translates, and hence we must hold Dr Atkinson as the responsible party here.

Three parts of the work are upon our table, and so far as the publishers are concerned, they deserve nothing but praise. The size is convenient, the paper good; the type clear and elegant; the paragraphs and chapters well divided; and the woodcut illustrations numerous and beautiful. Mr Bailliere could have done no more. Yet the work is one that we should hesitate to put, as an educational one (for which it is intended), into the hand of any youth, or recommend as a text-book to any practical man.

Besides the radical fault that we have referred to, it abounds in the most slovenly wording, and in many places with palpable errors.

Turning *passim* over the pages, we find such passages as the following—here is a definition of specific gravity:—"Specific gravity is the ratio of the relative weight of a certain volume to that of an equal volume of distilled water, at the temperature of 4° C." p. 22. Would it not be equally specific gravity if referred to any other body, solid, liquid, or gaseous—and at any temperature whatever—to say nothing about all omission as to barometer pressure?

The explanation of the method of double weighing, at p. 33, is certainly curious—"The body to be weighed is placed in one scale, and shot or sand poured into the other until equilibrium is re-established. The sum of these weights will necessarily be equal to the weight of the body; for, acting under precisely the same circumstances, both have produced precisely the same effect."

At paragraph 67, chap. v., under the head of Elasticity of *Traction*—a word, we may remark, not English, but French, and for which the correlative used in our own tongue by nearly every author is *tension*, while *extension* is the corresponding effect; and for which, we presume, *extraction* could scarcely be substituted in English. We find it here announced—

"When the limit of elasticity has not been exceeded, the traction of rods and wires is subject to the following law:—

1st, Rods and wires possess perfect elasticity—that is, they assume their original length as soon as the traction ceases——!"

Here is the definition of Elasticity of *Flexure*—why elasticity of flexure should be a different thing from that of elasticity of traction (*i e.* tension and compression) is not told:—

"A solid, when cut into a thin plate, and fixed at one of its extremities, after having been more or less bent, strives to return to its original position when left to itself;" very rebellious conduct on the part of the thin plate, but, we apprehend, not partaken of by such a plate, if of wax or clay. Ductility, it appears, "is the property in virtue of which a great number of bodies change their forms by the action of traction or pressure"—*i e.*, it is the same thing as extension or compression. We always hitherto thought that ductility meant the balance or relation between tenacity and hardness as measured by the extent to which a ductile body can be reduced in diameter by the *compression* of the draw-plate when pulled through it. Again, we are told that "malleability is that modification of ductility which is exhibited by hammering." Byron said that a Scotchman ought to have known that a bagpipe did not mean a pibroch; what property of a drawplate can be exhibited by a hammer is more difficult to discern.

Here is the next sentence. "The most malleable metal is lead." Of course we all know that gold-beaters generally prefer lead to gold, and that sheet lead can be made much thinner than gold leaf.

After a pretty lucid account of the Hydraulic Press, at p. 64, et seq.—though introduced, such a place and way, that the relation between liquid *head* or hydrostatic column and the action of the small *pump* is wholly lost sight of, or obscured to a learner—we are told that the hydraulic *press* is used in all cases where great pressures are required, and also serves to *test* the strength of *cannon and steam boilers*. Is the press put into the boiler, or the boiler into the press; or is the latter used to crunch up the boiler; or how is a *press* in any way so applied?

At the end of this—part I., par. 94—we find the gem of confusion, where the author or translator treats of "floating equilibrium." We cannot spare space to quote or to dissect a passage, in which it would scarcely be possible more completely to confuse a plain subject, or make it more hopelessly unintelligible to a learner.

The ability to float at all, and the conditions of stability when floating, are all mystified together. Here is a precious sample of elementary clearness. "The less the density of a solid, in reference to a liquid, the more *readily* does it float." We thought a body floated or did not float, and that the fact was never one of degree. "An egg placed in water sinks immediately, because it weighs more than an equal volume of water, but if it is *immersed* in water *supersaturated* with salt it swims"—so—When is water *supersaturated* with salt? We fancied that *immersed* bodies were those that did not float.

Above all other things, looseness of definition is injurious to the learner, or to the man of small information; for such, the intellectual food should be like the dinners of middle-class people—simple, but good.

There are very few in the work that are clear, and very many that are either wrong, or so slovenly expressed, as to lead to error. Take par. 103, part II. The metre is defined to be the ten-millionth part of the "earth's quadrant." Which quadrant? We need not say it is the ten-millionth of the arc of the *meridian* of Paris.

In par. 143, it is observed that in our climate the barometer in fine weather is generally above 758^{mm}, and below this in rain, &c. The *our* here refers to France—a continental climate—and the statement is not quite true of our insular one. If Dr Atkinson has undertaken the task of translator, why should the French measures and weights of the original not be translated also into English ones. We find the same thing at p. 147. How is an English student, without waste of time in calculation, to read off 760 millimetres on an English barometer?

At p. 118, we are informed that "the quantity of a gas, which a liquid can dissolve, is independent of the nature and of the quantity of gas which it already holds in solution." Then, if it have already dissolved a quantity of *any* gas, it can still dissolve more of it, without limit for anything above to the contrary. So we might go on from page to page, were it worth while to multiply such examples. In part III., p. 152, we notice a grave misstatement. "Mallet has investigated the transmission of *sound* in various *rocks*, and finds that it is as follows:—

Wet Sand,............................	825	feet	per second.
Stratified Rock,........................	1088	,,	,,
Discontinuous Granite,.............	1306	,,	,,
Solid Granite, ...	1664	,,	,,

We knew not before that *wet sand* was a *rock*. Passing that, however, these determinations are not of sound at all, but of waves of impulse of large amplitude, and whose transit period may differ enormously from those of sound in the same media.

The characteristic, beyond all others, that distinguishes French works of science, based on mixed mathematics, is exquisite precision and clearness of language—it is this that makes them so truly precious as educational works. If this one of M. Ganot's be not itself an exception, the author has no reason to thank the translator for the dress in which he has been presented to us here.

But, in any case, for the reasons given at the beginning, as to the mixing up of essentially distinct subjects in the original work, and with such beautiful books to choose from—as M. Jamins' Physics; and the still more perfect and clear volumes of the "Leçons de Mechanique Practique;" of Morin; and others that might be named—it would have been no loss to have left M. Ganot untranslated.

In conclusion, we would add, that the third part, being generally of physics proper, is less inaccurate than the two preceding.

EUCLID'S PLANE GEOMETRY.—BOOKS I. to VI.—PRACTICALLY APPLIED: OR GRADATIONS IN EUCLID. Parts I. and II. By Henry Green, A M. 8vo. Pp. 441. Manchester: John Heywood, 1861.

IT is a pleasantly striking fact, that Manchester, the great centre of applied mechanics, should have given to the world a portly volume of Euclid's Plane Geometry, "practically applied." Its issue from the Lancashire industrial focus, is indeed, a most significant indication of something like sound progress in fundamental mechanical teaching, on the very spot where theories are so rapidly and so well reduced to practice. Euclid's name is so frequently a bug-bear to student beginners, that any one who lends a hand in smoothing any difficulties, and softening the rough aspect of the great teacher of old, must be looked upon as a great public benefactor. If he enforces the great truths which come ready to his hand, on a system, and in language which simplify the process of acquiring what is aimed at, without in any way enfeebling the power of the gigantic original expounder,—he at once establishes for himself the position of a profoundly just instructor. Mr Green has shown his right to such a title, in this well and clearly arranged volume—for he has made it less a vehicle for the conveyance of mere theoretical instruction in geometrical knowledge, than an instrument for the direct practical application to the concerns of life of those great leading truths which regulate all positive mechanical construction. As an assistant to those in a humble station of life, nothing can well be better than Mr Green's book; and it may very properly form an introductory ground work for men of higher calibre, and loftier ambition.

THE ECONOMY OF STEAM POWER ON COMMON ROADS, in relation to Agriculturists, Railway Companies, Mine and Coal Owners, Quarry Proprietors and Contractors, with its History and Practice in Great Britain. By Charles Frederick T. Young, C.E. And its Progress in the United States. By Alexander L. Holley, C.E., and J. K. Fisher. 8vo. Pp. 421. Wood Engravings. London: Atchley & Co., 1861.

STEAM Locomotion on Common Roads has latterly received a new and most important impulse, from the now almost universal determination of mechanical engineers to decide whether or not its practical application is a fact or a vision. For quick passenger traffic, however, we are afraid that we are nearly as far off the consummation of any settled results of value as in the days of Colonel Macerone and Mr Hancock. For slow work, such as the conveyance of great weights of machinery and agricultural produce, and the transport of heavy guns and military stores, a better prospect is being opened up, and the heads of military departments, and even farmers have begun to scan with favourable eye the probabilites of ultimate success. Hence, as we must have mechanical as well as other land marks to guide us, as we must have milestones to indicate the progress we are making, we are glad to make our bow to Messrs Young, Holley, & Fisher the joint British and American authors of the volume, now under examination. In discussing the subject they have conjointly taken in hand, the consideration of the economy of steam on common roads, and the application of the giant power in agricultural operations generally; stating, together with its admitted advantages, the details of the various attempts hitherto made in the way of accomplishing its practical establishment as a general locomotive worker, the causes of failure after failure, and especially why steam traction exists even yet but in theory. What may be called the "concentrating" and "distributing" systems as regards the weight of the engine, cover all the tried plans which have ever been proposed by practical men, in working out common road steam locomotion, the weight, under the first mentioned system, being concentrated upon a small bearing surface, and under the second, upon a large area. This book deals practically in showing the results of both systems; and we are glad to say, more in the way of facts, than as regards theoretical fancies. The volume is divided into the subjects of—Transports—Roads—Canals—Railroads—Comparison of Roads—Railroads and Canals—Substitution of Steam for Animal power—Steam on Common Roads—Concentrated Weight—Distributed Weight—Boydell's Traction Engine and Endless Railway—Cost of Working—Steam in the United States—Passengers by Steam on Common Roads—Why Steam traction is not more general to reduce Tolls—Conclusion.

What Mr Young says on the advantages of the substitution of steam for animal power, forms a very important section of the volume, as it presents a lucid and comprehensive view of the gain to be attained, well fitted for the study of the non-technical employers of mechanical power, and thus enabling them at once to see how to begin, and where to stop the employment of steam, on a basis wide enough to take in all general purposes. Such a generalised statement is most in its tendency to advance the application of steam in a really available manner, and at the same time, to repress the often too wild schemes for its use, which only lead to complication and loss. Going back to Cugnot, a French engineer, who made a three-wheel common road locomotive in 1769, the author gives us a succient history of the slowly progressive steps of common road locomotion by steam, from its earliest dawn, to the condition in which we now find it; and from this, much is to be learnt by contrasting the failures and successes, as they alternated with ever varying prospects throughout the eventful period between "then and now." The energy with which the movement has been carried on, is well exemplified in the fact that in the year 1833, there were built, and building, in London and the neighbourhood, no fewer than nineteen different steam carriages, the list being headed by the name of Hancock, who had five in hand all at once; then came, in 1854, Mr Scott Russell's successful attempt in Scotland, where he for some time ran seven and a half mile trips between Glasgow and Paisley, in 40 and 45 minutes. This line, for a real line of steam conveyance it was, was put an end to by the Scotch Courts, on the casual breaking of a wheel, which resulted fatally. From that time, little or nothing has been done on common roads until within the last year or two.

The concentration of the weight had at first many more admirers than distributed weight, and there are abundant reasons why the earlier experimentalists should have adopted the former, instead of the latter view. We now see every day, how much the judicious distribution of the weight has to do with the practical extension of the system, and the recent efforts of Ricketts, Fowler, Burrell, Boydell, Aveling, and others, are all satisfactory evidence of this. The same may be said of Mr Fisher's engine of 1859, in the United States. The fastest passenger travelling yet accomplished is, we fancy, that attained by an engine built by Mr Ricketts for the Earl of Caithness in 1860. The noble owner has himself performed seventy miles in one day, with this engine over the hilly, but hard roads of Caithness-shire, occasionally reaching twenty miles an hour. We have already engraved this well constructed engine in the *Practical Mechanic's Journal.*

There are still many difficulties in the way of the extension of steam travelling on common roads, mostly arising however from the bare ripeness of the age, for its general adoption, and consequently to a large extent visionary. But no engineer can read the volume we have just considered, without arriving at the conclusion that he will very shortly see steam on common roads a far more nearly accomplished fact, than the bulk of the world at present imagines.

MECHANIC'S LIBRARY.

Arithmetical Examples, Key to, Part I., 18mo, 1s, cloth. Davis.
Astronomy of the Ancients, Survey of, 8vo, 15s, cloth Lewis.
Astronomy, Handbook of Descriptive and Practical, 13s. Chambers.
Blow-pipe Vade Mecum, 8vo, 4s, cloth. Hanghton.
Builders' and Contractors' Price-Book for 1862. 4s. Revised by Burnell.
Builders' Price-Book, 1862, fc. 8vo, 4s, cloth. Laxton.
Builders' Prices, 1862, 8vo, 4s, cloth. Skyring.
Chemistry, Elements of, part 3. "Organic Chemistry," 2d edition, 20s. Miller.
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Conic Sections, Solutions to Problems in, crown 8vo, 4s 6d, cloth. Drew.
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Drinking Cups, Vases, &c., for Use of Gold and Silver Smiths, 10s 6d.
Engineers', Architects', and Contractors' Pocket Book for 1862, 6s.
Engineers' Pocket Book for 1862, 6s, roan. Adcock.
Infinitesimal Calculus, Treatise on, vol. 4, 8vo. 16s, cloth. Price.
Integral Calculus, Treatise on, 2d edition, 10s 6d, cloth. Todhunter.
Land, Ready Reckoner for, "Weale's Road Series," 1s 6d, cloth. Armur.
Nautical Magazine, 1861, 8vo, 13s 6d, boards.
Operative Mechanic's Workshop Companion, 7th Edition, 5s. Templeton.
Science, Recreative, vol. 3, 4to, 7s 6d, cloth.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents

(To the Editor of the Practical Mechanic's Journal.)

Being a constant reader of your valuable *Journal*, I shall esteem it a favour if you will insert the accompanying history of the fanner in the *Practical Mechanic's Journal*, provided you think well of it.

John Sked.

Woolwich, January, 1862.

HISTORY OF THE FANNER.

The revolving Fan or Fanner is supposed to be a Chinese invention, and is said to have been used by them for centuries in separating the husk from the paddy in their rice mills, and was brought to Europe by the Dutch upwards of 200 years ago (who were then in the zenith of their commercial prosperity, and "swept the seas"), and to have reached Scotland in the early part of last century.

It is somewhat singular and corroborative of the alleged invention of the winnowing by the Chinese, that they have still in use machines similar to those used in Europe upwards of a century ago.

In the year 1710, James Meikle, millwright, of Salton, in Haddingtonshire, father of Andrew Meikle, inventor of the thrashing machine, was sent to Holland at the expense of the celebrated Andrew Fletcher, of Salton (who was then exiled in Holland on account of being the last and most determined of the Scottish nobility who opposed the "Union"), to learn the art of making decorticated, or as it is familiarly termed, pot barley, and constructing barley mills, both of which arts were then utterly unknown in this country.

A letter from Mr Fletcher to Mr Meikle, dated the "Hague," June 18, 1710, which letter is still in possession of a descendant of the Meikle family, giving him directions about making and purchasing several articles necessary in the erection of the barley mill, and amongst other things, *a pair of fanners* for separating the dust from the finished barley, which this mill, like every other, had attached to it; and these fanners, erected at Salton, in Haddingtonshire, were the first ever employed in Britain.

It is stated that Meikle, after arriving in Holland, experienced considerable difficulty in obtaining a view of the interior of a barley mill, and devised the following expedient to accomplish the object of his mission, viz.: he pretended love to a miller's daughter, and obtained access to the mill on a Sunday when the miller was at church; but he had to retrace his steps homewards with all expedition, as the Dutch, who were then decidedly in advance of every other nation in Europe with regard to mills, were exceedingly jealous of their designs being pirated by foreigners.*

About twenty years afterwards, fanners were constructed on a larger scale, and employed for winnowing corn. At this period the case containing the vanes was neither circular nor eccentric, and resembled a square packing case with a convex top. The method for accelerating the speed of the vanes was accomplished either by a pair of grooved wooden pulleys and a small rope—but the general plan was by what is termed cog and trundle gearing; the cog wheel was constructed entirely of timber, and the trundle or pinion consisted of two iron discs, having stout wire for the round. But the farmers at this period were so very superstitious that few could be induced to use them; they declared that they were the invention of the devil, and that they would rather wait for the natural wind, which they alleged was better adapted for cleaning corn than the wind from fanners.

About the middle of the eighteenth century, vibrating riddles or sieves were added to the fanner by a millwright, of the name of Rodgers, residing near Hawick, which improved their efficiency in separating foreign seeds, &c. Since then numerous improvements of a minor character have been added; among others, that of the flannel clad revolving cylinder, for separating grub grass seed.

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* When Meikle visited Holland in 1710, he found the barley mills revolving in a horizontal plane, like the mills in China for husking rice at the present day, but after having some experience with the first erected mills in Haddingtonshire, he arranged the stone to revolve in a *vertical plane*, which enabled the mill to be more quickly emptied, and was considered a great improvement.

In 1849, a marked improvement on the winnowing machine was introduced by a person residing near Wisbeach, in Lincolnshire, who seemed to recognize two governing principles inherent in a fanner for dressing grain, viz.: first, that the grain, &c., to be operated on should be subjected to the blast of air *before it acquires any velocity in falling;* and secondly, that the current of air, instead of being of uniform density, ought to be strongest immediately below where the heavy corn is intended to fall, and be gradually attenuated to a gentle zephyr where the chaff and other light impurities are deposited. This was accomplished by a very simple expedient, in the shape of a deflecting board situated nearly at the bottom of the case containing the vanes, and which imparted to the blast a heterogeneous character, and caused the different qualities of grain, seeds, and chaff to be deposited according to their respective weights or specific gravities.

Subsequently the same person, by a skilful disposition of the blast, effected a revolution in the mill fanner or chaffing machine, whereby its action was rendered so perfect that especially wheat and oats could be sacked direct for market without being passed through the usual finishing fanners.

About the same period a millwright, then residing near Dunbar, in Haddingtonshire, introduced *alternate truncated cones* for altering the speed of mill fanners, which enabled the attendant to regulate the blast with much nicety, so as to adapt it to the different specific gravities of the corn to be operated on.

In order to maintain the efficiency of thrashing-mill fanners, it is of much importance that there should be a free and direct escape from the chaff apartment for the effluent wind; in cases where this provision is not properly attended to, the fanners are rendered inoperative, and, as might be anticipated, the corn, seeds, and chaff, &c, flow down the fanner shoots without separation.

APPLICATION OF THE FAN FOR EXCITING COMBUSTION.

In the year 1735, Dr Desaguliers, an eminent experimental philosopher, brought under the notice of the Royal Society of London, what he termed the centrifugal machine or rotary bellows, for producing a continuous blast, and for extracting air and blowing fires and furnaces; but it seems to have been of limited utility until the year 1827, when the late Mr James Carmichael, engineer, Dundee, applied his fertile mind to the subject, and instituted a series of experiments with high speeds and oblique moving vanes, which rendered it a machine applicable for an infinity of practical purposes. Mr Carmichael first applied it to the blowing of his cupolas and forges, and for discharging the waste material and ventilating the flax mills in Dundee; and I may here remark, that Mr Carmichael, with his wonted liberality, offered it to the world without any restrictions, which benefits he might have secured to himself by protecting the invention by Letters patent. It has since been employed extensively in ventilating public buildings, and for drying wool with heated air after being cleansed, previous to the process of carding in modern woollen manufactories; and it has been much used for cooling brewers' and distillers' wort.

The eccentric case was introduced upwards of 30 years ago, and has up to the present day been extensively copied in the construction of fans for blowing forges and furnaces, but it seems to be a refinement of doubtful utility; some of our best fans have concentric cases, having a clear space of 3 inches all round the revolving vanes.

In the year 1848, Mr Lloyd, engineer, Southwark, introduced a marked improvement on blowing fans, which produced nearly double the blast from a given amount of impelling power, compared with the common fan. It is allowed, in reference to the common fan, that there must be always more or less of a partial vacuum formed behind each vane when revolving, and that the air which is condensed in front must rush over the ends and sides of the vanes to fill up the vacuity so formed, causing no doubt that disagreeable humming noise which is common to all the ordinary fan-blowers, and absorbing a large portion of the power employed for no better purpose than beating the air within the case.

In Mr Lloyd's patent fan the vanes are enclosed between two wrought iron discs, forming a species of diaphragm, to which they are securely fixed, and revolve with the vanes, thus forming an internal revolving case, which discharges the air into the external drum in manner similar to missiles projected from a sling.

A Lloyd's fan, having a revolving case 4 feet diameter, the vanes 18 inches wide at the centre, and 6 inches at the circumference, having inlet openings 18 inches diameter, and performing 1300 revolutions per minute, will furnish sufficient blast, at a pressure equal to 10 inches of water, to blow a large cupola having tueyre openings represented by 160 square inches, and capable of melting 100 tons of iron in 10 hours; the fan expending nearly 11 horse-power.

Properly curved vanes moving obliquely seem to operate on the moving air with a minimum of friction, and do not break or disturb the flow. Curved vanes moving acutely produce nearly the same blast, but require more power and impart a violent tremor or vibration to the case, which renders it difficult to fix.

In all cases the diameter of the vanes should be proportioned to the quantity of air discharged in a given time; when the inlet openings are small, considerable power is wasted in accelerating the flow of the entering current.

J. Sked.

(To the Editor of the Practical Mechanic's Journal.)

I hope that you will consider the enclosed letter suitable for the pages of the *Practical Mechanic's Journal*, and that you will be able to make use of it for your February number. I think it right to tell you that a letter of the same kind has already been published in a Scientific journal by myself, but that I have here explained my views in a more complete, and therefore satisfactory, manner.

THE CONNECTION BETWEEN THE SPECIFIC HEAT AND THE COMPACTNESS OF SUBSTANCES.

The fact that the specific heat of substances is diminished with every increase in their compactness, which it is proper to distinguish from their density (weight or gravity), is in my apprehension a very notable one; and this, inasmuch as from it, it may be concluded that all substances are compact, their parts are in an increasing degree closely compacted, in proportion to the smallness of their specific heat, which conclusion is a tolerably evident one. It does not follow, *à priori*, that substances are heavy in proportion to their compactness, or, which as regards their weight is the same thing, the smallness of their specific heat, and, indeed, experience does not shew that this is invariably the case; it is the rule, but to it there are many exceptions and irregularities: the specific heat (compactness) of bismuth, for example, would, were the rule without any exception, lead us to conclude it to be the heaviest of metals; and by comparing the specific heats of gold and mercury, we should be warranted in concluding that the former substance is only slightly heavier than the latter, which, from experience, we know is not the case, of which instances the former is one of exception, and the latter one of irregularity. The compactness of substances is generally confused with their density, which is only another name for their weight or gravity, whereas, while compactness is a different condition, it is not even clear that in any case it is the cause of density, but on the contrary, it is probable that it never is. It should be remembered that no examination, however minute, of any substance, is sufficient to shew the degree of its compactness, and this because, however its interstices are seen, it is not possible to know to what degree its solid parts, which are mixed with indiscernible interstices, are compacted or compressed. The fact that all substances are not dense in proportion to their compactness, which proves that compactness is not, at any rate in every case, the cause of this condition, also affords reason for supposing that it never is, and supports the experiments of Mr O'Neill, which have been described in the *Mechanics' Magazine*, No. 116, new series. No connection exists between the density of substances and their hardness, or resistance to separation and compression, neither between their specific heat and the late mentioned condition. It is clear that those substances which have the least specific heat are the most compact, inasmuch as this condition, which depends upon the amount of interstitial space in any substance, in which the vibrations of the interfluent ether are produced, is affected by their compactness; the most compact substances having only little space for these vibrations, which causes the heat to which they are subjected soon to be diffused throughout their various parts, or renders their specific heat small; and those less compact having more space, which allows of larger vibrations, which are not so soon diffused throughout their various parts, or renders larger their specific heat. It has for some time appeared to me that, in the way of possibility, the hardness of any substance is not dependent upon its compactness; and now, as a criterion of the last named condition has been found, it is demonstrable that this is not the case. Every individual is aware that the density (weight) of any substance is not a function of its resistance to separation and compression. It is true that all substances are rendered harder by compression, but from this fact it must not be concluded that the hardest substances are those which have the most been compacted, although the supposition is an allowable one. This case is not similar to that respecting the specific heat and the compactness of substances, inasmuch as concerning that, only one supposition can properly be aimed at, which must, therefore, be the conclusion; whereas, concerning this case, several suppositions may, in the way of possibility, be formed. I apprehend that the condition of hardness is dependent upon molecular arrangement, and that that of density or gravity must be set down to the same cause.

I am, Sir, faithfully yours,

J. Alexander Davies.

Carlton Hill Villas,
Camden Town, January, 1862.

[To some of our correspondent's (Mr Davies) facts we must take exception. It is not true that there is *no* connection whatever traceable between density and hardness. It is not so either, that all substances (*i.e.* all solids) are rendered harder by compression. In metals this is only true of some. Mr Davies' notions as to the mechanism of the ether vibrations in solids do not seem to rest upon a true scientific basis. And we would ask—what means have we of knowing anything whatever about the relation between volume and mass, except through specific gravity; or what means of knowing anything of the assumed solid *nuclei*, and of the vacuous intermolecular spaces to which he refers? Nevertheless, we print his communication as one not without suggestiveness to the molecular and chemical physicist.—Ed. *P. M. Journal.*]

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

BRITISH ASSOCIATION.

SECTION E. GEOGRAPHY AND ETHONOLGY.

"On the Connection between Ethnology and Physical Geography," by the President, J. Crawford, Esq.

"On the Direct Overland Telegraph from Constantinople to Kurrachee," by Major-General Sir H. C. Rawlinson.

"Remarks on the Proposal to form a Ship Canal between East and West Loch Tarbet, in Argyllshire," by J. Ramsay.

"On the Ethnology of Finnmark, in Norway," by L. Daw, of Christiania.

"Remarks on a Proposed Railway across the Malay Peninsula," by H. Wise.

"Notices on the Ethnology, Geography, and Commerce of the Caucasus," by Captain Cameron.

"On the Geography and Natural History of Western Equatorial Africa," by P. B. Du Chaillu.

"On the Acclimatization of Man," by Dr J. Hunt.

"On the Osteology and Dentition of the Natives of the Andaman Islands," by Professor Owen.

"A Letter from the Colonial Office, on the Exploration of N. W. Australia, under Mr Gregory."

"An Appeal on behalf of the only Son of the Great Traveller, the late T. Aitkinson, Esq.," by Sir R. I. Murchison.

"A Letter from Sir Hercules Robinson, Governor of Hong Kong, relating to the Progress of Major Sard, Captain Blakiston, and others, who are endeavouring to pass from China to the North of India."

"On the Mountains forming the Eastern Side of the Basin of the Nile, and the Origin of the Designation 'Mountains of the Moon' as applied to them," by Dr Beke.

"Notice of a Volcanic Eruption on the Coast of Abessinia," by Dr Beke.

"Cromleachs and Rocking Stones considered Ethnologically," by P. O'Callaghan.

"Remarks on the English Gipsies and their Dialects," by C. Smart.

"On the Antiquity of Man, from the Evidence of Language," by J. Crawfurd.

"On the Antiquity of the Aryan Languages," by R. Cull.

"Journey in the Interior of Japan, with the Ascent of Fusiyama," by R. Alcock.

"On some Account of the Romans in Britain," by Dr R. Wollaston.

"Spitzbergen Current, and Active and Extinct Glaciers in South Greenland," by Col. Shaffner.

"On the Geographical Science of Arctic Exploration, and the Advantage of continuing it," by W. P. Snow.

"Remarks on the Glacial Movements noticed in the Vicinity of Mount St Elias, on the North-west Coast of America," by Sir E. Belcher.

"On the People of Western Equatorial Africa," by P. B. Du Chaillu.

"On the Relations of the Population in Ireland, as shown by the Statistics of Religious Belief," by the Rev. A. Hume.

"On the New Route to Western China," by H. Duckworth.

"On the Capabilities for Settlement of the Central Parts of British North America," by Dr J. Hector.

"On Australia, including the Recent Explorations of Mr Macdonald Stuart," by the Hon. J. Baker.

"The Great Earthquake at Mendoza, 20th March, 1861," by W. Bollaert.

SECTION F. ECONOMIC SCIENCE AND STATISTICS.

"A Glance at the Cotton Trade," by T. Bazley.

A century ago the population of Manchester was below 30,000, whilst now 350,000 persons reside in and occupy it. Population and wealth have wonderfully increased and ramified to other places; but now, in the zenith of prosperity, a mysterious hand has written upon our walls the words of caution and of admonition. During the last fifty years upwards of 20,000,000,000 pounds weight of cotton from all sources have been consumed in Great Britain and the value would be probably not less than £750,000,000 sterling, or might equal a sum of the amount of our National Debt, the chief supply having been obtained from the United States of America. Upon a fair computation, the import of that material, which has so largely employed the capital and labour of this country, has yielded a profit of not less than £1,000,000,000 sterling, to the people of the United Kingdom within that period. The wonder is, that so large a supply of cotton could be procured from that one source, the United States; and when we reflect that this country possesses a monopoly of the vast extent of territory found in the whole world capable of producing this raw material, the inference is most palpable, that there has been developed the most successful agricultural industry in the States of America which has been either ever contemplated or realized; whilst in British colonies and dependencies apathy and neglect have prevailed. If the legislature had little sympathy with the great industry of Lancashire, the interest of our foreign possessions might have induced our rulers to stimulate productions in them, which would have found compensating markets at home. The advocates of large and of independent supplies of raw cotton, from all possible sources, have never desired Governmental favours, their object having been to promote the removal of repressing obstacles, and to procure, by the aid of a sound colonial policy, at least a fair share, in proportion to the extent of our foreign possessions, of not only cotton, but of every other product which they might more abundantly have yielded. During the last year the consumption of cotton in Great Britain was 85 per cent. from the United States, 8 per cent. from other foreign sources, and 7 per cent. from British territory. The present position of the trade is most precarious and dangerous. Existing stocks and prospective supplies of cotton may enable the mills to be worked into the spring of next year, at moderately full time; but afterwards, unless supplies be received from the United States, independent sources can only furnish the means of keeping the mills at work little more than one day in the week. With the growth of this industry 5,000,000 of our population have become directly and indirectly dependent upon it for their subsistence; and the productiveness of their capital and labour, including the raw material, was for the last year nearly eighty million pounds sterling. Of this large value twenty-five millions of cotton manufactures were absorbed in the consumption of the people of the United Kingdom, and their remained for exportation fifty-five millions. The estimated capital engaged in its fixed and floating investments, is two hundred millions of pounds.

"On the Price of Printing Cloth and Upland Cotton from 1812 to 1860," by Alderman Neild.

"On the Altered Condition of the Embroidery Manufacture of Scotland and Ireland since 1857," by Dr J. Strang.

"On the Connexion of Improvements in Cotton Bleaching with Improvements in the Condition of the Factory Population," by H. Ashworth.

"Prices in England, 1582-1620, and the effect of the American Discoveries upon them during that period," by Professor Rogers.

"On the Progress of Improvements in Manchester and Salford during the last Twenty Years," by D. Chadwick.

"On Strikes," by Dr J. Watts.

"On Co-operation and its Tendencies," by E. Potter.

"On the Rochdale Co-operative Societies," by D. Stone.

"Co-operative Stores: their Bearing on Athenæums, &c.," by the Rev. W. R. Thorburn.

"On the Progress of Co-operation at Rochdale," by the Rev. W. N. Molesworth.

"Some Account of the Manchester Gasworks," by J. Shuttleworth.

"On the Employment of Women in Workhouses," by Miss Twining.

"Notes on the Progress and Prospects of the Trade of England with China since 1833," by Col. Sykes.

"On the Relative Pauperism in England, Scotland, and Ireland, 1850—60," by F. Purdy.

"On the Commerce and Manufactures of the Colony of Victoria," by W. Westgarth.

"On the Recent Improvements in the Health of the British Army," by Dr W. Farr.

"On the Growth of the Human Body in Height and Weight in Males from 17 to 30 Years of Age," by J. T. Danson.

"On the Extent to which Sound Principles of Taxation are embodied in the Legislation of the United Kingdom," by W. Newmarch.

"On the Definition and Incidence of Taxation," by Professor J. E. T. Rogers.

"The True Principles of Taxation," by C. E Macqueen.

"On a Revision of National Taxation," by Dr W. Clarke.

"The Income Tax," by the Rev. Canon Richson.

"The Commercial Relations between England and France," by R. Valpy.

H. J. Ker Porter, presented Engravings of Farm Labourers' Cottages, with a Specification, and made a few remarks, in continuation of a Paper read at Oxford in 1860.

"On Sanitary Improvements," by Mrs Fison.

"Ten Years' Statistics of the Mortality amongst the Orphan Children taken under the Care of the Dublin Protestant Orphan Societies," by the Rev W. Caine.

"On some Exceptional Articles of Commerce and Undesirable Sources of Revenue," by C. Thompson.

"On the Inspection of Endowed Educational Institutions," by J. Heywood.

"On the Government System of Examinations in Science," by Captain Donnelly, R.E.

"On the General Results of the Census of the United Kingdom in 1861," by J. T. Hammack.

"Comparative Progress of the English and Scottish Population as shown by the Census of 1861," by Dr J. Strang.

"An Examination of the Increase and Decrease of Population in England and Wales, 1851-61," by T. A. Welton.

"On the Influence of Density of Population on the Fecundity of Marriages in England," by R. H. Bakewell.

"On the Condition of National Schools in Liverpool as compared with the Population, 1861." by the Rev. A. Hume.

"On the Economical Effects of the Recent Gold Discoveries," by H. Fawcett.

"Can Patents be defended on Economical Grounds?" by Professor J. E. T. Rogers.

"On Capital Punishments and Crime," by H. Ashworth.

SECTION G. MECHANICAL SCIENCE.

The President read an Opening Address.

Mr J. Oldham read a report "On the Progress of Steam Navigation at Hull."

Mr Atherton, Chief Engineer of Woolwich Dockyard, read a very valuable paper, "On Freight as affected by difference in the Dynamic Performance of Steamships."

Dr Grace Calvert read a paper, in which he gave the results of investigations into the qualities of some woods suitable for ship-building.

He had examined ten different kinds of woods, and the superiority of some of them to English oak could not be too strongly impressed upon the nation. In woods grown in tropical countries the tannin of the English oak is replaced in some instances by resins, and in others by substances similar to caoutchouc. Such was the case with Moulmein teak, Santa Maria and Moria woods, and these woods had therefore great advantage over oak in resisting decay. The facilities for mildewing and decaying were as follows: unseasoned oak, rapid; seasoned oak, rather less; African teak, Honduras mahogany, limited; Moria wood, Santa Maria, and Moulmein teak, none. During his researches he found great difference between oak felled in summer and oak felled in winter; the latter was rich in tannin, the former contained little tannin, but a large quantity of gallic acid. In examining the specimens of wood taken from the well-known gunboats, he found the chemical composition of the wood from the sound boats was identical with that of seasoned oak felled in winter, whilst that from the unsound boats was identical with that of unseasoned oak felled in summer.

Mr J. Scott Russell brought before the Section the Report of the Steam Ship Performance Committee.

Mr J. Heywood brought before the Section the Report of the Committee on the Patent Laws.

The report pointed out that the revision of the Patent Laws had been one of the objects which had from the foundation of the Association engaged its attention; that since the new Patent Law of 1852 many of the grievances connected with the subject had been remedied, but that still many remained to be removed. These had formed the subject of discussion at the Committees of the Association. At the Liverpool Meeting in 1854, attention was drawn to the fact of £70,000 being annually taken from inventors in the shape of fees. The reports of the Committees at Liverpool, Glasgow, Cheltenham, Leeds, and Aberdeen all concurred in recommending that the surplus thus derived from fees, in preference to a reduction in such fees, should be applied at present to—1st, the erection of suitable offices for the Commissioners of Patents, and a free library of reference and consultation; 2ndly, the erection of a museum for the preservation and exhibition of models of inventions.

Mr Hughes read the resolutions passed at a meeting of the Committee of the Manchester Patent Law Reform Association, held on the 30th of August, 1861.

Sir W. G. Armstrong then read a paper "On the Patent Laws."

Mr T. Webster followed, with a paper "On Property in Invention and its Effects on the Arts and Manufactures."

He pointed out that considerations of public policy had led to certain rules or laws respecting the use and enjoyment of all property, and that the same principles to which the origin of all property is to be referred, had peculiar claims to recognition with regard to the inventor. To say that an inventor may retain command over his invention by secrecy is to propose an impossibility in a majority of cases, and in the few cases in which it might be done the effect would be to convert his art into a mystery and restrictive practices long since condemned. The author pointed out the fallacy of stigmatizing patents as contrary to the principle of free trade, as was commonly done. He admitted the injury done by the indiscriminate grant of patents; and this, which might be remedied, ought not to be used as an argument against the system. He pointed out that although for small inventions and such as could be quickly introduced a patent might not be needed, yet that where time and capital were required to introduce the inventions into use, such inventions would not be made and perfected unless the inventors were protected from piracy by letters patent. He thought the cases of obstruction, in practice, were more imaginary than real. The law admitted of successive patents for improvements; and practically it was rare that a prior inventor would not come to reasonable terms with a subsequent one.

Mr Webster then read a paper contributed by R. A. Macfie, "On Patents considered internationally."

Mr W. Spence read a paper "On Patent Tribunals,"

In which he argued against the practicability of any plan of preliminary investigation of the merits of inventions before granting patents in any form that had been suggested. He, however, thought that the difficulties in the way of preliminary investigation did not apply to the trial of cases after a patent had been granted, and he fully concurred in the necessity of a special tribunal for such purpose.

At the end of the reading of the foregoing papers a lengthened discussion took place—Lord Wrottesley pointed out the importance of the speakers distinguishing carefully between the evils which could be cured by legislation, and those which could not. Mr W. Fairbairn (the President of the Association,) said the object of the Patent Law Reform Association was to lessen the cost of patents, and improve the administration of the law, not to do away with it. Mr R. Grove said the question of patents or no patents was one which was fairly arguable, and personal convenience or inconvenience had much to do with the part which individuals might take. The number of patents granted for frivolous inventions was an evil no doubt; but the objection on this score applied rather to the mode of granting than to the principle of patents generally. If any restraint were put on the indiscriminate grant of patents, it was possible, that in stopping a number of frivolous patents, a valuable invention, which might in the first instance appear frivolous, would be denied the privilege. This, however, was a risk that all things were liable to. He would not discuss the question of natural rights. Was it an encouragement to the inventor, and did you by locking up the invention injure the public? That was the point of view in which he thought it should be looked at. Assuming Sir William Armstrong to be right in desiring to abolish patents altogether, he thought it impossible to do so at the present time, as the public, at all events, were not yet prepared for it; and while that was so, the result must be injurious, as no law could be abolished or altered with a satisfactory result unless the public as a body were prepared to receive it.

The Mayor of Manchester said he was connected with a large manufacturing firm, and had some experience of the way in which the Patent Laws acted as a stimulus to invention, and he pointed out the difficulties which existed in introducing a new invention unless protected by patent. He, however, did not think that any Court for preliminary examination was practicable. No such Court could ever get through the work: the utility of the invention ought not to be entered upon, as it could not fairly be judged beforehand, and novelty could not be tried, as nobody would take the trouble to make the necessary search for the purpose. He, however, thought that there should be a special Court to try patent cases. Captain Blakeley thought that patents were neither useful to the public nor inventors. The Right Hon. J. Napier thought that on the grounds of justice and policy patents should be granted, but he condemned the present system on which patents were granted indiscriminately. The law officers of the Crown, of which he had been one, were heavily taxed with their professional and official duties, and could not give that attention to the granting of patents which was in his opinion essential. He considered that an inventor should make out a *primâ facie* case before the patents should be granted to him. He also advocated a special tribunal.

Mr R. Roberts said, that his experience had shown him that without the protection of a patent no inventions requiring time, skill, and capital to perfect, would ever be made, and he instanced the case of his own invention of the self-acting mule, which had taken some years to perfect and a large outlay of capital. Mr Winkworth spoke in favour of the abolition of all patent rights. Mr J. Scott Russell said, that he advocated the views of Sir William Armstrong as regarded the abolition of patents, but as to the establishment of any tribunal for rewarding inventors he considered that as only suited for Utopia.

Dr Eddy read "A Proposal for a Class of Gunboats capable of engaging Armour-plated Ships at Sea, accompanied with Suggestions for fastening on Armour-Plates."

Captain Blakeley, R.A., then brought forward his paper "On Artillery *versus* Armour."

"On the Iron-cased Ships of the British Admiralty," by E. J. Reed.

Mr T. Aston read a paper "On Elongated Projectiles for Rifled Fire-arms."

"On Iron Construction, with Remarks on the Strength of Iron Columns and Arches," by F. W. Shields.

"On the Deflexion of Iron Girders," by B. H. Stoney.

"On the Applications of the Hydraulic Press," by E. T. Bellhouse.

"On the Application of Workshop Tools to the Construction of Steam-Engines and other Machinery," by J. Robinson.

"On the Application of the Direct-Action Principle," by W. B. Johnson.

"On the Resistance of Ships," by Professor Macquorn Rankine.

Professor Thomson, of Belfast, presented his final Report of "Experiments on the Gauging of Water, by means of V. Notches."

W. Fairbairn, President of the Association, presented a paper containing a series of "Experiments on the Effects of Vibratory Action and Long-continued Changes of Load upon Wrought-Iron Bridges and Girders."

Mr D. Chadwick, Secretary of the Manchester Cotton Supply Association, read a paper "On Recent Improvements in Cotton Gins."

A description was given of the old Indian churka, one of which was exhibited to the Meeting, and the invention of the American saw gin, by Eli Whitney, was also noticed and described. On the recent visit of Dr Forbes, the superintendent of the cotton gin factory of the late East India Company, to Darwhar, he introduced an improved cotton gin, based upon the principle of the Indian churka. This churka gin had subsequently been improved by Mr John Dunlop, of Manchester, and Messrs. Platt Brothers, of Oldham, and the improved machines were exhibited to the Meeting. The improvements in Messrs Platt's machines consisted in the application of spike rollers revolving at different speeds in connection with vibrating machinery, which transmits the cotton to the ordinary churka rollers. The effect of this is to enable the machine to be supplied with cotton at intervals instead of continuously with the finger. The machine is intended to be worked by power, and requires the attendance only of a child thirteen years of age. Mr Dunlop's machine was less expensive, more compact, bearing a closer resemblance to the original churka, and was intended to be worked by hand.

Mr T. Bazley, M.P., said the machines before them were wonderful improvements on the old churka. He noticed the destruction of fibre and the waste occasioned by the American saw gins, and said he had seen cotton in the market selling for 7*d* per lb. which, if cleaned by a roller gin, would have sold for 2*s* per lb. The injuries inflicted upon the raw cotton were not so great as upon the long fibre cotton, because the teeth of the saws allowed the short fibres to go through without severing them. During the last few years, an improved kind of roller gin, known as the Macarthey Gin, had been introduced into America. An intimate friend of his had obtained one of these gins, and placed it in the hands of Mr Dunlop, who had made a large number of these gins, which the Cotton Supply Association had forwarded to the various cotton-producing districts of the world. But when he turned to the machine which had been constructed by Mr Platt, that appeared to him to be the machine best adapted for the cleaning of a very large quantity of cotton in a short time without injury to the fibre. He was very glad to see these machines in the room, though he feared they should soon be in the position of the cook who had all the appliances for cooking a good dinner, but was without the mutton and the beef to cook. He was afraid unless very serious efforts were made, this great industry of theirs would be very much depressed:—Mr Ashworth said he believed the Indian cotton, which, as now cleaned, was worth 4*d* per lb., would be worth 5*d* per lb., if cleaned by the cotton gins exhibited.

Mr J. F. Bateman, President of the Section, made a communication, "On Street Pipe Arrangements for Extinguishing Fires."

Mr C. W. Siemens explained a system of telegraphic communication adopted in Berlin in the case of fires, by means of which immediately after a fire occurred the police at every station in the town could be informed of the occurrence, and of the district in which the fire had occurred.

Col. Sir. H. James, R.E., described the process of "Photozincography," by means of which photographic copies of the Ordnance maps are cheaply multiplied, either on their original, or on a reduced or enlarged scale. The process is applicable to the reproduction of old manuscripts and old printed books.

Mr Haworth read a paper explaining his patent for improvements in street railways, by the addition of a fifth or perambulator wheel to the carriages, running as a guide in a central groove between the trams. It was calculated that a saving of 35 per cent. would be effected by this plan.

M. Vignoles expressed his opinion that if any street railway were ever adopted, Mr Haworth's system would be the one. He had never seen a more promising system.

GEOLOGICAL SOCIETY OF IRELAND.

On Wednesday evening, 11th Dec. 1861, there was a general meeting, in the Museum Buildings, Trinity College, Dublin. There was a very full attendance of members. The chair was taken by the President, the Rev. Professor Haughton.

The following papers were read on the subject of the Irish Elk. By Professor H. B. Geinitz, of Dresden, an honorary member of the society, "On the Cervus (Megaceros) Hibernicus, from the County of Limerick, in the Royal Museum at Dresden," and by the President, "On the discovery of an Irish Elk in the Queen's County, with a notice of allusions to this animal in the Book of Lismore." The discussion was taken jointly upon both the preceding papers.

Dr. Petrie (the eminent Archæologist) asked what was the general opinion of scientific men as to the question of the antiquity of these remains?

President—Doctors differ. Some believe that the elk existed long before the creation of man, others that the ancient Irish killed and ate him. The best evidences in favour of the latter view were contained in a pamphlet written by Dr. Harte, and also the work by Gosse, "The Romance of Natural History," and the writings of Richardson. The only evidence on the other side was of a negative character. The only alleged case of human remains being found with elks' bones had turned out to be a mistake. Elks' bones were found in great abundance in France. As far as the foot of the Pyrenees.

Dr E. Perceval Wright.—The Museum of Trinity College possessed a very fine series of the Irish elk, perhaps the finest in existence. In addition to two perfect male skeletons and one female, there were eleven of the male skulls, and one of the female animal. The skeletons referred to possessed not only the rare phalanged bones, but also perfect sets of incisor teeth. From an examination of more than thirty specimens of the heads and horns of the Megaceros, Dr. Wright was of opinion that all the supposed sword cuts, &c., on the horns were not the work of men cotemporaries of the elk, but of the workmen engaged in raising them from the bogs.

Professor Jukes, director Geological survey of Ireland, mentioned a head of a Megaceros seen by him which had been taken from a bog, at a railway cutting near Rathdrum. It was so deposited in bog and no clay that he supposed the time of the deposition to have been between the commencement of the bog and the growth of the top. He believed the Megaceros to have been contemporaneous with the Mammoth. He did not know of its bones being associated with flint implements. Man and the Magaceros may have been cotemporaneous in other countries and not in Ireland, as man at the time might not have come so far west.

Dr. Stokes in reference to what Dr. Wilde had said as to the want of notice of the elk in "early Celtic literature," doubted very much if we had any reliable Irish literature anterior to the eighth century. As to the notice in the Book of Lismore, it was to be expected that any notice of the elk there would be in a mythical form. Whether cotemporaneous with man or not, the Megaceros would appear to be a very late animal. In truth, its remains were not fossils at all. He had, while a student, analyzed some of the bones, and he found no fossilization, the earthly and animal ingredients being in the same proportions as if the animal had recently died. When Archdeacon Maunsell presented a skeleton to the Royal Dublin Society, in his letter accompanying he stated that he had found marrow in the bones, which burned when ignited; along with that skeleton were found some ancient Irish jet rings. He believed that if the Megaceros were not cotemporaneous with man, it was nearer to him than any other extinct animal that we know of.

We have given the report of this discussion at some length, as a connecting link in the evidence that is daily accumulating, and connecting the existence of the human race with the extinct animals of the Pleistocene period.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY.

December 5, 1861.

"On Hydrostatic and Steam Cranes." By Mr A. Chapman.

December 12, 1861.

"On the Haddon Tunnel." By Mr J. S. Allen.

December 19, 1861.

"On the Theory of Steam and other Heat Engines." By Mr F. Campin.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

December 10, 1861.

"On Rain following the discharge of Ordnance." By Mr Rascendale.
"On Examples of Relative and Absolute Law." By Dr R. A. Smith.

December 24, 1861.

Mr Brockbank exhibited some samples of steel manufactured by Mr Bessemer's process. These specimens had been bent and twisted cold, and showed a remarkable degree of ductility. He stated that the Bessemer steel was one of the most plastic and manageable of metals—more so even than copper. It could be bent, flanged, or twisted, either hot or cold, without annealing, and over a considerable range of temperature—which is not the case with ordinary steel or copper. A plate of 18 inches diameter had been forced through a series of dies until it formed a tube 13 feet long and 1¾ inches diameter, without any crack or flaw. A ring of metal could, at one heat, be hammered into a die to form a locomotive engine chimney top. In drilling a circular hole into a plate continuous shavings are formed—whereas, in copper or Low Moor plates, or any other metal, the shavings break into pieces 1-16th in. long. Thin sheets of the Bessemer steel can be bent backwards and forwards hundreds of times without a fracture, and are almost as flexible as paper.

"On the influence of the seasons on the rate of decrease of the temperature of the atmosphere with increase of height, in different latitudes of Europe and Asia," by Mr Baxendell.

January 7, 1862.

"Experiments on some Amalgams," by Mr J. P. Joule.

SOUTH WALES INSTITUTE OF ENGINEERS.

December 12, 1861.

"On the Sanatory condition of Mines." By Mr Mark Fryer, Glasgow.

"On a plan to improve canal locks, and to render canal carriage less costly. By Mr G. Ashcroft.

"On Giffard's Injector." By Mr T. D. Steel.

ROYAL SOCIETY.

December 12, 1861.

"On a Series for calculating the ratio of the circumference of a circle, to its diameter." By Mr Clarkson.

"On the Production of Vibrations and Sounds by Electrolyses." By Mr Gore.

"On Perchloric Acid, and its Hydrates." By Mr Roscoe.

January 9, 1862.

"Preliminary Note on the Nature and Qualities of Voltaic Electricity," by Mr Gore.—"On the Diurnal Tides of Port Leopold, North Somerset," by the Rev. S. Haughton.—"On the Posterior Lobes of the Cerebrum of the Quadrumana," by Mr Flower.—"On the General Forms of the Symmetrical Properties of Plane Triangles," by Mr T. Dobson.—"Note on Ethylene-dichloride of Platinum," by P. Griess and Dr Martins.

FRENCH ACADEMY OF SCIENCES.

December 23, 1861.

This was the meeting for the distribution of the annual prizes. The Lalande prize for astronomy has been awarded to MM. Tempel, Luther, and Hermann Goldschmidt. The Monthyon prize for experimental physiology has been awarded to MM. Hirte, of Vienna, and Kühne, of Berlin. In the same meeting, M. Flourens delivered an oration in memory of Prof. Tiedmann, the celebrated anatomist, who died on the 22d of last January.

January 6, 1862.

This was the first meeting of the year. The president, M. Milne Edwards, the illustrious naturalist, retired in favour of his natural successor, the vice-president, M. Duhamel, the mathematician. M. Velpean, the surgeon, was chosen vice-president for the present year, so that he will be president in 1863.

INSTITUTION OF ENGINEERS IN SCOTLAND.

JANUARY 8, 1862.

"On Veneer-Cutting Machinery." By Mr Hunt.
"On Wood-Planing Machinery." By Mr Norman.

SCOTTISH SHIP-BUILDING ASSOCIATION.

JANUARY 6, 1862.

"On Apparatus for Submarine Operations." By Mr A. Brown, Renfrew.
"On Lloyd's Rules for Iron Ships." By Mr J. G. Laurie.

ASSOCIATION OF ASSISTANT ENGINEERS IN SCOTLAND.

JANUARY 7, 1862.

"On Marine Governors." By Mr Roberts.

MONTHLY NOTES.

MARINE MEMORANDA.

The *Peru*, iron paddle steamer, built by Messrs. John Reid & Co. of Port-Glasgow, and fitted by Messrs. Randolph, Elder, & Co. with high pressure condensing double cylinder engines, for the Pacific Steam Navigation Co., when tried in the Mersey, attained a rate of 14½ miles an hour, with 35 pounds steam pressure, and 24½ revolutions of the engines. Her engines are the tenth pair supplied by the same makers to this company.

STAFFORDSHIRE IRON.—A set of breaking-test trials have recently been carried out at Chatham, for the purpose of settling the mechanical value of a superior class of wrought-iron, made at the works of Earl Dudley, at Dudley, and intended to be used for the hull of the *Achilles*, war steamer. A large number of examples of plate, bar, angle, and T-iron were subjected to trial under hydrostatic pressure, with excellent results. The Admiralty standard is 22 tons to the square inch with the grain, and 19 tons against it. Earl Dudley's iron, on this occasion, with one exception, withstood the 22 ton test, without showing any flaw, whilst the bulk of the samples stood up to 28 and 30 tons, before any sign of a flaw was shown. In one case a piece with a section of two inches square endured 64 tons, when even the ram itself, of the hydrostatic press gave way. There is little doubt that the *Achilles* will be fitted with this iron, provided price does not offer any bar.

The Commissioners of Northern Lighthouses are engaged in the erection of a lighthouse on the commanding promontory of St Abb's Head, Berwickshire, from designs of their engineers, Messrs Stevenson, of Edinburgh. The illuminating apparatus has been fitted up by Messrs Milne & Son, of Milton House, Edinburgh, with the exception of the optical part, which was furnished by Messrs Chance, Brothers & Co., of Birmingham. The apparatus is of the description termed a first-class holophotal light. It consists of eight of Fresnel's lenses arranged in the form of a polygon, above and below which are placed eight panels of Mr Thomas Stevenson's holophotal prisms. The whole forms a gigantic polygonal cage of glasswork, six feet nine inches in breadth, and nine feet in height. It is caused to revolve by a powerful machine, and the speed is duly regulated so that the axis of each of the systems of lenses and prisms shall pass the eye of the mariner at intervals of ten seconds. The illumination is produced by a large lamp with four wicks, and supplied with oil by clockwork. The effect of the successive flashes is very striking, and readily distinguishable from an ordinary revolving light. The flashing light was an invention of the late Mr Robert Stevenson, and was introduced by him by means of reflectors at Buchanness Lighthouse in the year 1824. A similar light is now being constructed for the Monach Isles, a remote group lying to the westward of the outer Hebrides; and, if the apparatus can be finished in time, the Commissioners have been requested by the London Committee of the International Exhibition to exhibit it at the forthcoming Exhibition.

The great ship building yards of the Wear turned out last year 126 vessels, amounting to 46,758 tons. The Wear has long been the greatest mart for wooden ships in the empire, but iron shipbuilding is now making considerable progress, and out of the 126 vessels launched in 1861, 17 were iron. The extensive works of Mr William Pile, which never set an iron vessel afloat until last year, turned out upwards of 3,000 tons of iron shipping during 1861, being more than one-half of the entire production of the shipyard for the 12 months. The state of the trade generally for the last 10 years will be seen at a glance by the following table:—

Year.	No. of Ships Built.	Aggregate Tonnage.	Average Tonnage.
1852	142	56,645	398
1853	152	68,479	454
1854	151	66,929	443
1855	151	61,159	405
1856	154	63,049	406
1857	143	54,780	383
1858	110	42,003	381
1859	100	47,284	371
1860	112	40,201	358
1861	126	46,758	371

Of the vessels built last year 56 were purchased for Sunderland, 26 for London, 16 for Shields, 7 for Liverpool, and the remainder were sold to 13 other ports. Prices may be quoted as follows:—An eight years' ship, of from 200 to 400 tons, 9*l*. 10s. per ton; a 10 years' ship, 11*l*. to 12*l*. per ton, and a 13 years' ship from 14*l*. to 15*l*. per ton. These rates include good sound outfits, but without sheathing metals. Vessels of 700 tons and upwards classed 10 years, may be quoted at from 14*l*. to 15*l*. per ton, and 13 years' class at from 17*l*. to 18*l*.

Capt. Ericsson, the American engineer, has a curious floating battery in hand. It is made up of two vessels—the lower, which is entirely submerged, is 124 feet long, 34 feet wide, and 6 feet 6 inches deep, and in it are the working machinery, the rudder, and anchor, out of reach of the enemy's shot. The upper vessel is built of iron, and is 174 feet long, 41 feet 4 inches wide, and 5 feet deep, with a draught of from 3 to 6 inches, leaving only 18 inches of the side exposed above the water line; a white oak bulwark 30 inches thick, and an armour of rolled plate iron, 6 inches thick, protect the vessel. The deck is of oak beams, 10 inches thick, covered with plank 8 inches thick and iron 1 inch thick. The upper vessel is flat-bottomed, and has a wedge-shaped stem and stern, and on its deck is a turret 9 feet high and 20 feet in diameter, composed of nine 1-inch iron plates, lapped over each and fastened with bolts. This turret can be turned by a spur-wheel and gearing driven by a double-cylinder engine, and controlled by a lever. By this contrivance the gun can be levelled at any point of the horizon almost instantly. Gratings in the deck are provided to pass off the smoke of the engines. This battery which is to cost 275,000 dols , is to be done by Jan. 15, and to make sure of its efficiency it is to be subjected to the fire of the enemy's batteries at ranges from 1,000 to 300 yards. Additional plates are to be addded if those first finished are found insufficient.

MISCELLANEOUS.

Fig. 1.

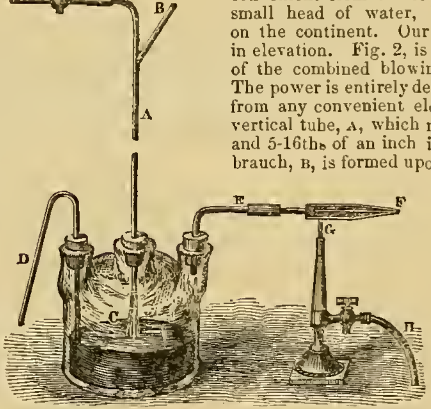
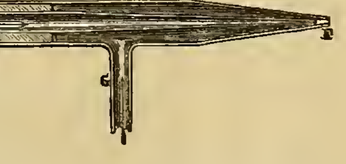


Fig. 2.



HYDRAULIC BLOW-PIPE.—A very simple and convenient form of blow-pipe, to be worked by a small head of water, has lately been introduced on the continent. Our fig. 1, shows the apparatus in elevation. Fig. 2, is an enlarged sectional view of the combined blowing mouth and gas burner. The power is entirely derived from the flow of water from any convenient elevated reservoir, down the vertical tube, A, which may be about six feet long, and 5-16ths of an inch in bore. A small air inlet branch, B, is formed upon the main tube, so that air can thus freely enter the tube, A, and mingle with the descending water. The lower end of the tube opens into the triple necked jar, C, of the capacity of a quart. On the water and air reaching the jar, separation at once ensues, and the water, which collects at the bottom, flows off by the siphon, D, the air is forced out by the opposite tube, E, being conveyed directly into the centre of a flame of coal gas burning at F, from the opening of one of Mangham's burners. The gas is supplied to the space inside the tubular burner and outside the air tube, E, by the pipe, G. The heat thus produced is most intense, so much so that it is desirable to make the tip of the burner of platinum, but all the other parts may be of glass or brass. Of course the blowing power will depend entirely upon the amount of water used.

MARQUETERIE ORNAMENTATION OF IRON.—A foreign inventor, Mr Hirschfeld, proposes the use of "Marqueterie" work on the general principle of that so long adopted for ornamental flooring and panelling. The Marqueterie material may be copper or other metal, or various woods, shells, tortoise shell, and mother-of-pearl may be employed. The Marqueterie is applied either directly to the iron surface, by means of any suitable glue or adhesive cement; or it may be laid upon a surface of wood, veneer, or cloth, previously secured to the iron surface to be ornamented. A great variety of iron articles may be ornamented in this way.

ELECTRIC PRODUCTION OF PRECIOUS STONES.—Valuable artificial minerals and crystals, it appears, can now be produced by electrical action. M. Becquerel, the eminent French chemist, has been busy for the last thirty years with the view of reproducing the minerals and crystals of nature by electric decompositions and re-compositions by feeble currents, and he has now obtained some very important results by substituting intense currents at a high tension. The two first substances acted upon were the silicate and aluminate of potash. The conditions of success are an absolute purity of the matter subjected to electrolyses, a determined strength of the solution, and a determined intensity of the current. From silicate of potash, beautiful spars, hydrophanes, and other crystals, endowed with all the qualities of those found in nature were produced. From the sulphate of alumina, he has obtained a hydrate identical with diopside; whilst from the hydrate there came topaz, corundum, and sapphire.

Extracts from Mr Thorburn's Annual Report of the Scotch Iron Trade.—Glasgow, 31st December, 1861.—The iron trade continues to manifest an irrepressible expansion. The quantity of Pig Iron produced in the last twelve months has been 1,035,000 tons, showing an increase of 35,000 tons over that of the preceding year. During the year the total deliveries amounted to 927,000 tons, and exhibit an increase of 24,000 tons when compared with those of 1860. The stock has therefore increased 108,000 tons, and is now (exclusive of Carron,) 535,000 tons,* lying in the makers' and warehouse-keepers' Stores. The fluctuations in the price have scarcely exceeded 2s 6d, either above or below the average price of 49s 3d per ton for the year. The Malleable Works, Foundries, and Shipbuilding Yards on the Clyde, have, as well as other branches of industry, felt, though not as yet severely, the disastrous effects of the American Revolution. Still the quantity of iron used in the local consumption has been only 3,000 tons less than that in the last year.

STATISTICS OF THE SCOTCH IRON TRADE.

PIG IRON WORKS IN SCOTLAND.	Furnaces, 31st Dec. 1861. In Blast.	Out of Blast.	Total.
Gartsherrie,	13	3	16
Eglinton,	8	..	8
Blair,	4	1	5
Lugar,	..	4	4
Muirkirk,	3	..	3
Glengarnock,	8	1	9
Ardeer,	4	..	4
Carnbroe,	4	2	6
Coltness,	9	..	9
Dalmellington,	4	1	5
Monkland,	8	1	9
Langloan,	6	..	6
Summerlee,	8	..	8
Dundyvan,	3	5	8
Clyde and Quarter,	7	2	9
Govan,	3	2	5
Calder,	6	2	8
Omoa,	3	1	4
Shotts,	3	2	5
Castlehill,	..	3	3
Wishaw,	..	3	3
Portland,	4	1	5
Kinneil,	4	..	4
Forth,	4	3	7
Lochgelly,	..	4	4
Lumphinans,	..	1	1
Carron,	4	..	4
Devon,	..	3	3
Almond,	2	1	3
Gladsmuir,	..	1	1
Garscube,	..	2	2
Nithsdale,	..	3	3
	122	52	174

Net Cash Average Price of Mixed Numbers per Ton, Delivered F.O.B. at Glasgow.

	1845	1846	1847	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859	1860	1861
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
January,	65 0	80 6	74 0	48 6	46 0	49 10	43 6	36 6	66 6	76 2	66 10	76 3	73 6	54 7	53 6	57 7	49 1
February,	74 0	77 6	73 6	49 6	51 0	47 5	43 0	36 3	54 10	78 0	61 2	69 10	73 9	56 3	51 11	60 0	48 0
March,	105 0	71 0	72 0	44 6	49 0	44 4	41 8	36 5	52 11	77 8	57 10	68 4	75 5	57 1	52 0	58 0	47 6
April,	107 6	65 0	71 0	42 0	47 6	43 0	41 4	36 0	52 8	79 5	60 0	72 11	75 0	53 3	51 3	53 11	48 1
May,	88 0	69 6	66 0	44 0	43 6	45 0	40 1	38 1	50 10	85 2	67 6	76 2	76 9	54 3	48 4	51 9	48 0
June,	65 0	68 0	65 0	42 6	44 0	45 6	39 5	40 0	52 9	88 8	75 8	75 3	77 4	52 6	48 0	50 3	49 6
July,	65 0	71 0	69 0	45 0	44 6	44 6	38 9	44 6	55 1	84 11	73 10	72 9	73 4	53 0	51 8	52 2	50 10
August,	67 6	74 0	68 0	45 3	45 0	43 8	38 1	45 0	64 1	83 5	78 0	73 0	70 0	55 1	52 10	51 11	51 1
September	82 0	74 0	67 0	45 0	42 9	42 6	39 0	48 0	63 6	82 7	81 0	71 6	67 8	54 4	51 9	51 3	51 0
October,	90 0	70 6	60 0	42 6	42 3	42 6	39 3	56 6	66 6	81 7	77 0	68 5	62 3	54 4	51 8	52 0	49 8
November,	77 6	69 6	51 6	41 6	44 4	43 0	39 3	58 0	78 2	71 9	76 6	71 3	53 8	53 8	52 4	52 5	49 3
December,	76 0	72 6	47 0	42 3	46 8	43 6	38 0	69 9	78 10	66 10	76 10	72 6	51 3	54 6	56 5	51 0	48 4
Average of the Years.	80 3	67 3	65 4	44 4	45 6	44 7	40 1	45 5	61 5	79 9	71 0	72 4	69 2	54 5	51 10	53 6	49 3
Average Price of Bar Iron in	£9 10/	£9 15/	£8 5/	£5 10/	£5 17/6	£5 9/	£5 7/6	£10 10/	£9 7/6	£9 15/	£8 15/	£8 17/6	£8 16/6	£7 10/	£7 7/6	£7 7/6	£7 0/

Price of Pig Iron in 1810, £9 5s; 1815, £7 15s; 1820, £7; 1825, £11; 1830, £5; 1835, £4 15s; 1840, £3 15s.
Production in 1788, 1,500 Tons; 1805, 9,000 Tons; 1820, 20,000 Tons; 1825, 29,000 Tons; 1839, 197,000 Tons.

Stock on hand, 31st December, 1860, ...427,000 Tons.
Stock in Warehouse-keepers' and Makers' Stores, 31st December, 1861, ...535,000 “

Increase of Stock, ...108,000 “

Exported Foreign and Coastwise from Glasgow, Firth of Forth, Ayrshire Ports, and per Rail,..590,000 “
Consumed in Local Foundries and Malleable Iron Works here, ...337,000 “

Total Deliveries, ...927,000 “
Add Increase of Stock, ...108,000 “

1,035,000 “

Computed Make in 1861, ...1,035,000 “
Average Number of Furnaces in Blast 1861, 123.

Furnaces in Blast.		Make.		Shipments and Home Consumption.	
On 31st December, 1845,	88	475,000 Tons,	in 1845,	390,000 Tons,	in 1845
“ 1846,	98	570,000 “	1846,	666,000 “	1846
“ 1847,	100	510,000 “	1847,	579,000 “	1847
“ 1848,	103	580,000 “	1848,	562,000 “	1848
“ 1849,	112	690,000 “	1849,	578,000 “	1849
“ 1850,	105	595,000 “	1850,	535,000 “	1850
“ 1851,	112	760,000 “	1851,	680,000 “	1851
“ 1852,	113	775,000 “	1852,	675,000 “	1852
“ 1853,	114	710,000 “	1853,	950,000 “	1853
“ 1854,	117	770,000 “	1854,	860,000 “	1854
“ 1855,	121	825,000 “	1855,	847,000 “	1855
“ 1856,	128	832,000 “	1856,	842,000 “	1856
“ 1857,	123	915,000 “	1857,	843,000 “	1357
“ 1858,	132	945,000 “	1858,	810,000 “	1858
“ 1859,	125	950,000 “	1859,	915,000 “	1859
“ 1860,	131	1,000,000 “	1860,	903,000 “	1860
“ 1861,	122	1,035,000 “	1861,	927,000 “	1861

Present Price of Bars, £6 10s @ £7........Plates, £8 @ £9 ....Rods, £8 @ £9, less 4 per cent discount for Cash........Rails, £6 @ £6 10s.
Railway Chairs, £3 15s @ £4........Cast Iron Pipes, £4 15s @ £6.
No. 1, Gartsherrie, 58s......M. N., G.M.B., 47s 6d........Ayrshire Brands, 48s @ 50s........East Coast Brands, 48s @ 50s........No. 1 Coltness, 53s.
No. 1 Calder and Glengarnock, 50s 6d.

* 186,200 Tons in Warehouse-keepers' Stores, ... } Exclusive of Carron Stock,
348,800 Tons in Makers' hands, ... } which is estimated about 70,000 Tons.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

25th November, 1861.

2962. John Halford, Beacon Cottage, Great Barr, near Birmingham, Staffordshire—Improvements in collecting and utilizing smoke, gases, and such like products of combustion, rendering the same available for heating steam boilers and other purposes where heat is required, which improvements are also applicable to the desulphurization of coal in making coke.

2963. George Clarke, Gresham Place, Camberwell Lane, Surrey—An improved fire escape.

2964. Phineas Cowan, Surrey—A mode of utilizing the waste heat of furnaces used in reburning animal charcoal.

26th November, 1861.

2965. Augustus W. Willis, Great Russell Street, Bloomsbury—Improvements in the construction of pencil cases or holders.

2966. Charles G. Braxton, Portsea, Hants—Improvements in propelling and steering vessels.

2967. James Brown, Ribchester Terrace, Bridge Road, Stratford, Essex—Improvements in fire bars and furnaces.

2968. Isaac Davies, Larkfield Nursery, Wavertree, near Liverpool—Improvements in the construction of roofs for dwelling houses, horticultural erections, and other buildings.

2969. Robert Harcourt, Birmingham, Warwickshire—An improvement or improvements in fastening knobs to doors, drawers, and other articles, and in connecting knobs to spindles.

2970. William Sellers, Keighley, Yorkshire—Improvements in means or apparatus for sewing.

2971. Charles Stevens, Charing Cross—Improvements in penholders.—(Communication from Jean B. A. Brasseur, Paris.)

2972. Charles Stevens, Charing Cross—An indelible anti-corrosive ink.—(Communication from Lonis Croc, Paris.)

2973. George Bottomley, St George's Place, Leeds, Yorkshire—Improved machinery for cutting up linen, cotton, woollen, and other rags, fibrous waste, or vegetable substances, for various purposes in the industrial arts.

2974. David Ker, Plymouth, Devonshire—An improvement in the manufacture of soap.

2975. William Firth and Robert Ridley, Leeds, Yorkshire—Improvements in apparatus and machinery for working coal and other mines.

2976. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—An apparatus for supporting the womb in cases of prolapsus uteri.—(Communication from Doctor Otto Langgaard, Berlin, Prussia.)

2977. George E. Donisthorpe, William Firth and Robert Ridley, Leeds, Yorkshire—Improvements in machinery and apparatus for working coal and other mines.

2978. George L. Purchase, Bedford Row, St. Andrews, Holborn—Improved apparatus applicable to and improvements in rifled and other muskets and ordnance and other fire-arms.

27th November, 1861.

2979. John Standfield, Stratford, Essex—Improvements in apparatus for regulating and indicating the speed of steam engines and other machinery.

2980. Francis A. Calvert, Manchester—Improvements in machinery and apparatus for burring, carding, and combing wool and other fibrous substances.

2981. Francois F. Dumarchey, Boulevart de Strasbourg, Paris—A machine to crush and pound all material peculiar to macadam and ore in general.

2982. George Rydill, Dewsbury, Yorkshire—An improved steam furnace or other boiler with smoke consumer and condenser, being also applicable for ventilation.

2983. William Leck, Glasgow, Lanarkshire—Improvements in weaving, printing, and otherwise treating certain ornamental fabrics.

2984. John Cook, Glasgow, Lanarkshire—Improvements in pendent lamps.

2985. Amos Whibley and Thomas Lumley, Gloucester Grove East, Old Brompton—Improvements in ventilators.

2986. Hermann Bramback, Lungengasse, Cologne—A new mode of manufacturing gas for illuminating purposes.

2987. Andrew Barclay, Kilmarnock, Ayrshire—Improvements in machinery or apparatus for boring and winding purposes.

2988. Horatio Mearing, Great Randolph Street, Camden Town—An improved lucifer match and prepared paper for igniting the same.

2989. Alfred V. Newton, Chancery Lane—Improvements in mowing and reaping machinery.—(Communication from William V. Anden, New York, U.S.)

2990. William Clark, Chancery Lane—Improvements in the clasps or fastenings of purses, bags, portfolios, tobacco pouches, and other like articles.—(Communication from Joseph Schoenfeld, Boulevart St. Martin, Paris.)

2991. William Clark, Chancery Lane—Improvements in the construction of parts of electric telegraph bell apparatus, and in apparatus used in making the same.—(Communication from Pierre D. Prudhomme, Boulevart St. Martin, Paris

2992. John H. Soller St. John Street Road—Improvements in cases for holding and supplying caps to the nipples of rifles and other fire-arms.

2993. Magnus Ohren, Sydenham, Kent—An improvement in the manufacture of gas and the apparatus connected therewith

2994. Michael Henry, Fleet Street—Improvements in the manufacture of soap and the preparation of materials for the purpose.—(Communication from Louis M. T. Riot, Boulevart St. Martin, Paris.)

2995. William Rowan, Belfast, Antrim—Improvements in machines for heckling and scutching flax and other vegetable fibres.

2996. Samuel Amphlet, Birmingham, Warwickshire—An improvement or improvements in ornamenting surfaces.

28th November, 1861.

2997. Henry Wilde, Manchester—Improvements in magneto-electric telegraphs, and in apparatus connected therewith.

2998. William Cooke, Spring Gardens, and Francis Squire, Fleet Street—An improved construction of paddle wheel for vessels propelled by steam or other motive power.

2999. Charles Stevens, Charing Cross—Improvements in furnaces for working iron ore.—(Communication from Joseph Bonne, Paris.)

3000. John M. Rowan, Glasgow, Lanarkshire—Improvements in the manufacture of railway wheels, and in apparatus to be used therein.

3001. Samuel A. Carpenter, Birmingham, Warwickshire—An improvement or improvements in attaching name plates or labels to umbrellas, parasols, walking sticks, and whips.

3002. Peter Spence, Newton Heath, near Manchester, Lancashire—Improvements in the treatment of ores for the manufacture of sulphuric acid, and in apparatus connected therewith, which apparatus is also applicable to the treatment of ores for separating metals therefrom.

3003. Frederic F. Weiss, Strand—An improved fastening for boxes and cases.

3004. Wilhelm A. V. Kanig, Brompton Row, Brompton Road, Brompton—Improvements applicable to stoves or open fire-places for utilizing more of the heat therefrom than heretofore, also for economizing fuel and igniting same.

3005. Jules D'A. de Labaume, Dorset Terrace, Clapham Road, Surrey—Improvements in machinery for cooling and freezing water and other fluids.—(Communication from Edouard Blée, Rue d'Amboise, Paris.)

3006. Benjamin Pitt, Great Carter Lane, and James J. Shedlock, Wendell Villas, Earls Court, Kensington—Improvements in cocks or valves for the passage of fluids.

29th November, 1861.

3007. Edward Funnell, East Street, Brighton, Sussex—A self-acting indicator signal for railways.

3008. Louis H. C. J. Carle, Brownlow Street, Holborn—Improvements in means or apparatus for indicating and registering the "score" for billiards and other games.

3009. Thomas Ellis, Swindon, Wiltshire—Certain improvements in rails for permanent ways.

3010. Augustus B. Childs, New Oxford Street—Improvements in wringing machines.—(Communication from Francis A. Cushmann, Lebannon, New Hampshire, U.S.)

3011. Samuel Tonks and Job Brookes, West Bromwich, Staffordshire—Improvements in steam boiler furnaces and in setting certain kinds of steam boilers.

3012. Robert C. Perry, Manchester, Lancashire—An improved infant's feeding bottle.

3013. Pacifico Tagliacozzo, Saint Mary-at-Hill—Improvements in lamps and utensils thereof.

3014. Richard A. Brooman, Fleet Street—An improved safety buffer or apparatus to be used in railway trains to prevent accidents from collisions.—(Communication from Richard D. Chatterton, Cohourg, Canada West.)

3015. Edward Tyer, Old Jewry Chambers—Improvements in electric telegraphs.

3016. Richard Cook and George H. Spencer, Hathersage, Derby—Improvements in the manufacture of umbrellas and parasols.

30th November, 1861.

3017. William Cooke, Spring Gardens, Saint Martins-in-the-Fields—A wind guard for curing smoky chimneys.

3018. John W. Gibson, Dublin—Improvements in ordnance applicable also to small arms.

3019. John Cooper, Ipswich, Suffolk, and Charles Garrood, Penge, Surrey—Improvements in cultivators, horse hoes, horse rakes and harrows.

3020. Edward Price, Cheapside—Improvements in collars for gentlemen's, ladies', and children's wear.

2d December, 1861.

3021. Alexander Schultz, Paris—Improvements in the manufacture of certain colours for printing and dyeing fabrics.

3022. James Wakenell, Hitchen, Hertfordshire—Improvements in the construction of invalid bedsteads, convertible into other articles of furniture for the use of invalids.

3023. William P. Bain, Blackwall—Improvements in protecting ships' bottoms from fouling.

3024. Gerard Ralston, Tokenhouse Yard—Improvements in the mode of preparing and applying a certain material on the hulls of iron or wooden ships, or on the surfaces of materials for building the same, also for preventing oxidation and tubercles in iron water pipes.—(Communication from Jacob Suider, jr., Paris.)

3d December, 1861.

3025. Thomas W. G. Treeby, Westbourne Terrace Villas, Westbourne Square, Paddington—Improvements in machines for boring holes in rocks and other hard substances.

3026. Robert A. Rust, Great Marlborough Street, Westminster—Improvements applicable to pianofortes.

3027. Andre M. A. Pichery and Pierre L. Danais, Nantes, France—Improvements in the hermetically stoppering or covering earthen, stone, glass, or any other matter, jars and pots of all sizes and shapes used whether for preserving butter, lard, and other provisions, or for containing chemical and pharmaceutical products or for other purposes.

3028. John H. Glew, Howland Street, Fitzroy Square—Improvements in machinery or apparatus for sewing or stitching.

3029. James Burrows, Wigan, and Joseph Dougan, Haigh, Lancashire—Certain improvements in winding or driving drums or pulleys.

3030. James Leach, Bronte Place, East Street, Walworth, Surrey—Improvements in preparing matters to be used in the manufacture of candles.

3031. George T. Bousfield, Loughborough Park, Brixton—An improved stopper for bottles, decanters, jars, and similar articles.—(Communication from William A. Shaw, Boston, U.S.)

3032. John L. Field, Upper Marsh, Lambeth, Surrey—Improvements in the manufacture of mould candles.

3033. Watson Duchemin, Charlotte Town, Prince-Edward's Island—Improvements in blocks for hoisting.

3034. William E Newtou, Chancery Lane—Improvements in artificial teeth.—(Communication from Samuel S. White, Philadelphia, Pennsylvania, U.S.)

4th December, 1861.

3035. William E. Gedge, Wellington Street, Strand—Improvements in the manufacture of nose bags and similar articles, and in apparatus connected with such manufacture.—(Communication from Felix Loignon and Victor Casse, Passage des Petites Ecuries, Paris.)

3036. James Hemingway, Robert Town, York—Improvements in the manufacture and ornamentation of textile fabrics.

3037. Thomas Stead and William Higham, Ashton-under-Lyne, Lancashire—Improvements in machinery or apparatus for spinning cotton or other fibrous materials.

3038. Charles Crabtree, Bingley, Yorkshire—Improvements in paper tubes, and in the means or machinery for making or manufacturing the same.

3039. James E. Boyd, Hither Green, Lewisham, Kent—Improvements in scythes, scythe handles, and apparatus for connecting the same.

3040. Henry G. Hacker, Woodford Bridge, Essex—Improvements in machinery for the manufacture of chenille and other circular pile fabrics.

3041. William E. Newton, Chancery Lane—Improvements in pumps.—(Communication from Calvin Woodward and George M. Woodward, New York, U.S.)

3042. Robert Kennedy and James Armstrong, Lisburn, Ireland—An improved arrangement of driving gear.

3043. William H. Balmain, Saint Helen's, Lancashire—Improvements in the manufacture of potash and salts of potash.

3044. Richard A. Brooman, Fleet Street—Improvements in albums or books for containing and showing photographic and other pictures, and in slides for the same —(Communication from Henry Strauss, Paris.)

3045. Abraham Pullan and William Lake, New Cross, Surrey—Improvements in traction and other engines, and in wheels for traction engines and other carriages, and in giving motion to ploughs and other agricultural machines.

3046. Charles S. H. Hartog, Norfolk Street, Strand—Improvements in the preparation and treatment of vegetable fibres, the better to adapt them for combining, working up, and dyeing with different fibres, such as silk, wool, cotton, and others, and in apparatus used in such treatment or preparation.

5th December, 1861.

3047. Allen T. Carr, Carlisle Street, Soho—The application of a material to the shoes on horses' feet for the purpose of preventing their feet from slipping.

3048. John Knowelden, Southwark, Surrey—Improvements in pumps.

3049. George W. Robertson, Cannon Street—Improvements in machinery for cleaning rice and other grain.

3050. John Wilson, Glasgow, Lanarkshire—Improvements in frames used for displaying trade show cards, pictures, or other similar devices.

3051. William Dicks, Floore, Northamptonshire—Improvements in pumps.

3052. James Cochrane, Harburn, Mid Lothian—Improvements in wet gas meters.

3053. William Busby, Newton-le-Willows, near Bedale, Yorkshire—Improvements in ploughs.

3054. Charles Davis, Bancroft Place, Mile End—An improved composition for coating metal and wood to preserve them from decay, applicable as a substitute for copper and other sheathing or other compositions now in use for coating ships' bottoms to protect them from the injurious action of water.

3055. Michael Henry, Fleet Street—Improvements in printing textile fabrics, and in constructing apparatus and producing surfaces for that purpose, the invention being also applicable to the mode of and surfaces and apparatus for producing devices on paper hangings and other materials.—(Communication from Alexandre A. Despreaux, Boulevart St. Martin, Paris.)

6th December, 1861.

3056. Edgar D. Scely, Thomas F. Wells, and George A. Phillips, Norfolk, Massachusetts, U.S.—Capping percussion fire-arms.

3057. Adam Woodward, Robert Woodward, and William Woodward, Manchester, Lancashire—Improved arrangements of compound steam engines.

3058. John Bailey and William H. Bailey, Salford, near Manchester, Lancashire—Improvements in apparatus for indicating the pressure of steam and gases, the amount of vacuum, the flow of fluids, the weight of materials, and the speed of bodies either revolving or traversing, and also the employment of aluminum or its alloys in the manufacture of the same.

3059. Charlotte Craddock, Orchard Terrace, Kensington—An improved system or method of cutting out ladies' dresses.

3060 John D. Napier, Glasgow, Lanarkshire—Improvements in brakes —(Communication from Robert Napier, Newcastle, New South Wales.)

3061. Edwin Collier, Aldershot, Southampton—Improvements in coverings for the feet and legs.

3062. Frederick Vetterlin, Scarborough Street—Improvements in breech-loading ordnance, and the projectiles to be used therewith and with small arms.

3063. William Smith, Kettering, Northamptonshire—Improvements in the construction of horse hoes.

3064. James Howard, Bedford—An improvement in the construction of haymaking machines.

3065. Heinrich G. Schramm, Rothenburgsors, Hamburg—Improvements in rotatory engines and pumps.—(Communication from Eduard Rosch, Lindenau, Saxony.)

3066. John J. Russell and Burdett L. Brown, Wednesbury, Staffordshire—Improvements in apparatus used in the manufacture of paper tubes.

7th December, 1861.

3067. Thomas Lawes, City Road—Improvements in the manufacture of quilts and coverlets.

3068. George Clark, Craven Street, Strand—Improvements in the use, application, and manufacture of iron or steel as armour for ships or batteries.

3069. Richard Jolley, St. John Street—An improved apparatus for heating, cooling, or drying, infusing, extracting, or absorbing vapours or gases for manufacturing, medical, or domestic purposes, and for preserving liquids and solids, alimentary or otherwise.

3070. George T. Bladon, Grove Lane, Camberwell, Surrey—Improvements in chimney tops for the prevention of down draughts in chimneys.

3071. Daniel May, Wood Street—An improved method of securing scarfs and similar articles to the neck.

3072. William N. Hutchinson, Devonport, Devonshire—Improvements in projectiles and ordnance, and in apparatus to be used therewith.

3073. Henry W. Bristow, Jermyn Street—Improvements in the manufacture or production of candles.—(Communication from Pierre L. A. Boillot, Paris, and Victor F. Cochen, Veslay, France.)

3074. Thomas Fearn and Thomas Cox, jr, Birmingham, Warwickshire—The application of certain electro deposits to the coating or finishing of the stretchers, ribs, and other metal portions of umbrellas and parasols.

3075. Thomas Mellodew, Oldham, Charles W. Kesselmeyer, Manchester, and John M. Worrall, Salford, Lancashire—Improvements in dyeing and printing certain descriptions of woven fabrics.

3076. Balthasar W. Gerland, Newton-le-Willows, Lancashire—Improvements in the manufacture of sulphate of copper and other salts of the same metal.

9th December, 1861.

3077. Rest Fenner, Red Lion Court, Fleet Street—Machinery for cementing the points of envelopes.

3078. Cromwell F. Varley, Fortess Terrace, Kentish Town—Improvements in electric telegraphs.

3079. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improved natatory apparatus.—(Communication from Leon Lejuste, Rue du Cauteleux, Douai, France.)

3080. Marc A. F. Mennons, Rue de l'Echiquier, Paris—A new or improved application of microscopic photography.—(Communication from Louis H. Bouillette and Jean A. Hyvelin, Rue Michel-le-Comte, Paris.)

3081. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in the production of relief designs on metallic surfaces for general printing, gaufering, and embossing purposes.—(Communication from Francois Debons and Theobald Denny, Rue Beauregard, Paris.)

3082. John Fordred, Brighton, Sussex—Improvements in treating linseed oil.

3083. Richard A Brooman, Fleet Street—Improvements in treating atmospheric air and other elastic fluids for motive power purposes, and in engines and apparatuses to be employed therewith.—(Communication from Charles D. Archibald, New York, U.S.)

3084. Richard A. Brooman, Fleet Street—An improvement in black lead pencils. —(Communication from Humblot Conte, Paris.)

3085. Stephen W. Silver, Bishopsgate Street, and Hall Pringle, King's Road, Chelsea—Improvements in shoes for horses and other quadrupeds.

3086. William Mason, Canton Street, Poplar—Improvements in applying armour or thick plating to ships and other structures.

3087. William Clark, Chancery Lane—Improvements in gloves.—(Communication from Alfred A. A. Cressent, Boulevart St. Martin, Paris.)

3088. Sussex Newton, Nutford Place, Edgeware Road—Improvements in apparatus for steering and stopping vessels.

10th December, 1861.

3089. Goldsmith Tear, Liverpool, Lancashire—Improvements for facilitating the drying of wet or damaged cotton or wool or other similar fibrous material.

3090. Hector Alexander, Glasgow, Lanarkshire—Improvements in turning apparatus for making gas burners.

3091. Henry Spencer, Rochdale, Lancashire—Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous substances.

3092. William F. Stanley, Great Turnstile, Holborn—The use of aluminum for the construction of mathematical instruments used for geometrical drawing, surveying, and nautical purposes, and improvements connected therewith.

3093. Joseph A. J. Redier, South Street, Finsbury—Some improvements in pocket watches.

3094. Victor L. Daguzan, South Street, Finsbury—A system of paving.

3095. George C. Lock, Liverpool, Lancashire—Improvements in cinder sifters.

3096. Thomas Higgins, Bow—Improved machinery for filling dipping clamps with tapers, match stems, and splints.

3097. William E. Newton, Chancery Lane—Improvements in breech-loading cannon.—(Communication from John Bryce and Benjamin De Forest, New York, U.S.)

3098. William E. Newton, Chancery Lane—Improvements in knapsacks.—(Communication from Joseph Short, Boston, U.S.)

3099. David Vogl, Sambrook Court, Basinghall Street—Improvements in garments for gentlemen and ladies' wear.

3100. John W. Agnew, Windsor Chambers, Great St. Helen's—A new and improved electro-voltaic pocket battery.—(Communication from Henry Palmer, London, West Canada.)

DESIGNS FOR ARTICLES OF UTILITY.

Registered from 10th December, to 22d January, 1862.

Dec.	10,	4422	Edward F. D. Walshe, Manchester Street, Manchester Square, W.—"Paper and envelope in one."
	12,	4423	John Collins Birmingham—"Rein holder."
	14,	4424	S Powell, Brook's Cottages, King Street, Old Kent Road, S.E.—"A breast drawer."
	16,	4425	The Shot Iron Company, West Nile Street, Glasgow—"Chimney Damper for Register Grates."
	18,	4426	John White, York Place East, Greenwich, S E—"Watch Protector."
	18,	4427	Alfred W. Miles, Brook Street, Hanover Square, W.—"A Pair of Trowsers, to be called the Arcanum."
	28,	4428	Richard Alty, Pilling, John Whiteside, Kirkham, Lancashire—"Reaping machine"
Jan.	3,	4429	Messrs R. and G Gray & Co., Pond's Works, Sheffield—"The Paragon Crinoline"
	6,	4430	Messrs Parkins and Gotto, Oxford Street, W—"Paper knife and book marker"
	10,	4431	William T Henley, St. John Street Road—"Improved Insulator"
	16,	4432	John W. Furday, Wednesbury—"Road or Street Kerbing and Channelling."
	17,	4433	Key Hoskins & Co., Birmingham—"Fastening a connection of the rails of metallic bedsteads and other articles."
	17,	4434	Christopher Alsop and George Mequire, Albany Road, Camberwell, S.—"A clothes horse."
	18,	4435	James J. Pratt, Sherbourne House, Rotherfield Street, Islington—"The new imperial train skirt improved"
	22,	4436	Duncan Stewart, Stone Buildings, Lincoln's Inn, W.C.—"A Butt for the game of lawn butts."

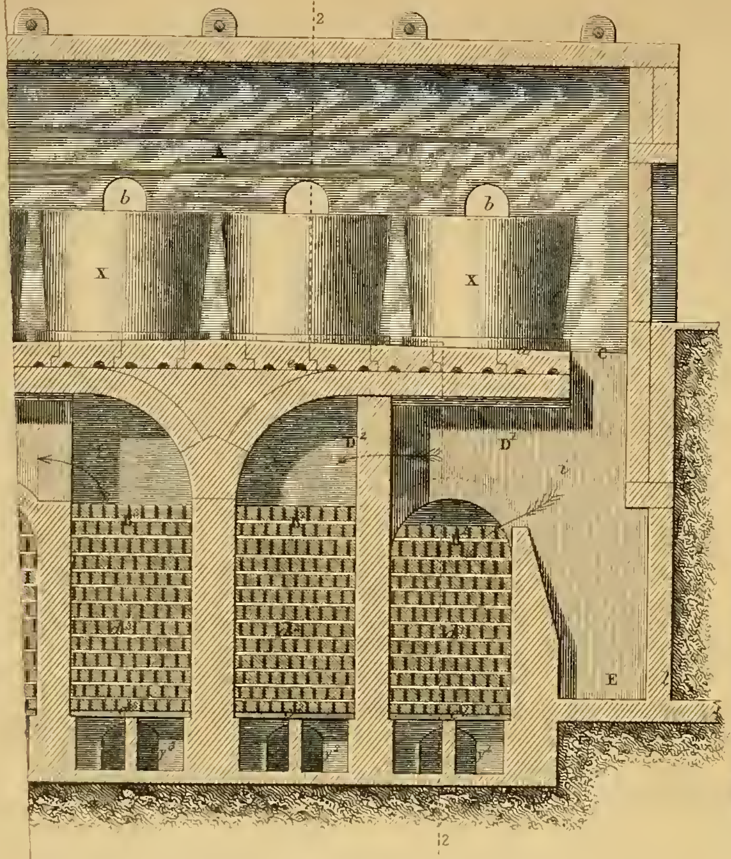
REGENERATIVE

BY MESSRS C

ENGINEERS

WEST

Fig. 1.



GLASS

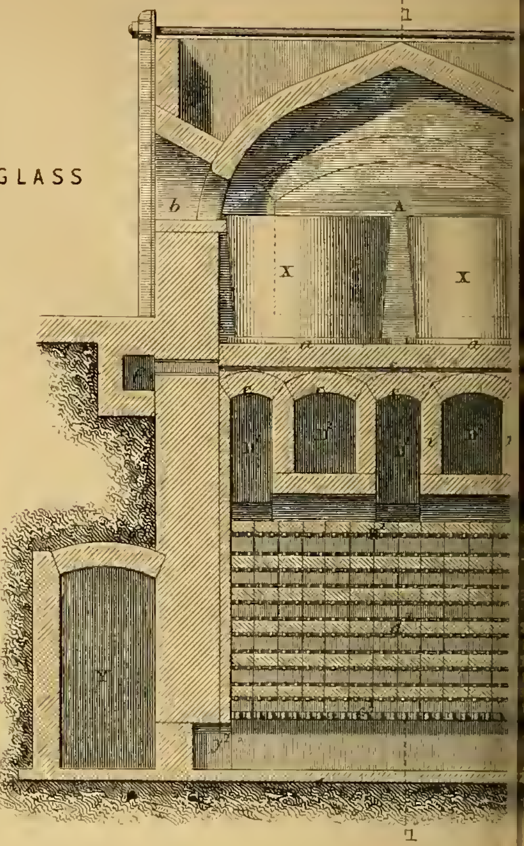


Fig. 3.

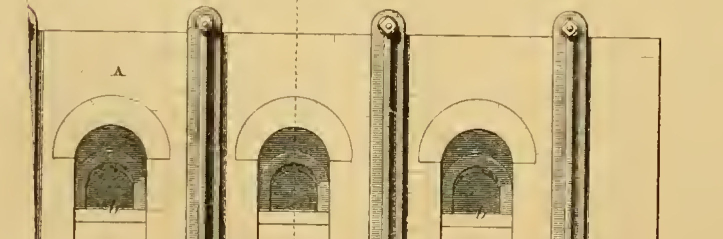
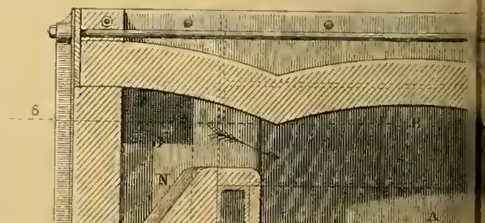


Fig. 5.



AS FURNACES,

& F. SIEMANS.

GEORGE ST.

NSTER.

Fig. 2.

FURNACE.

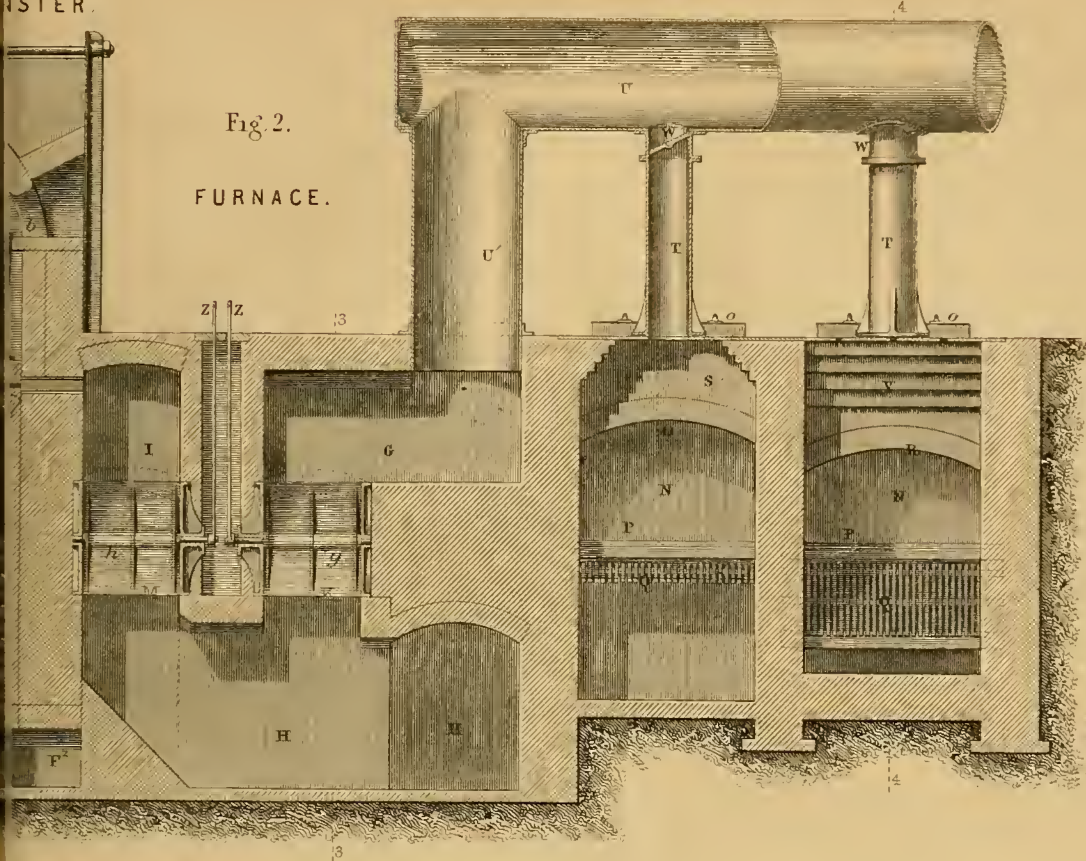
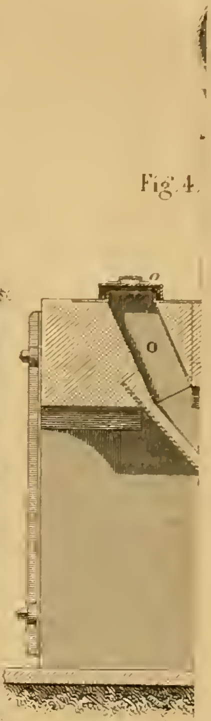


Fig. 4.



PUDDLING FURNACE.

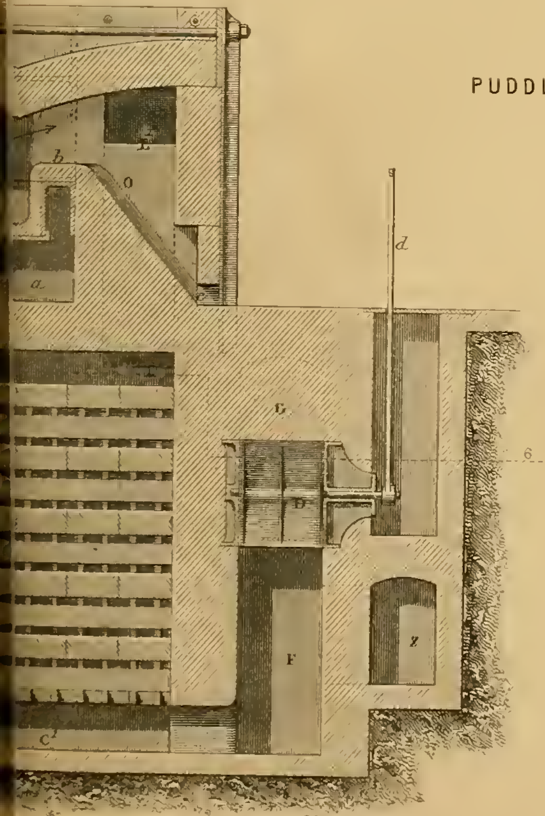
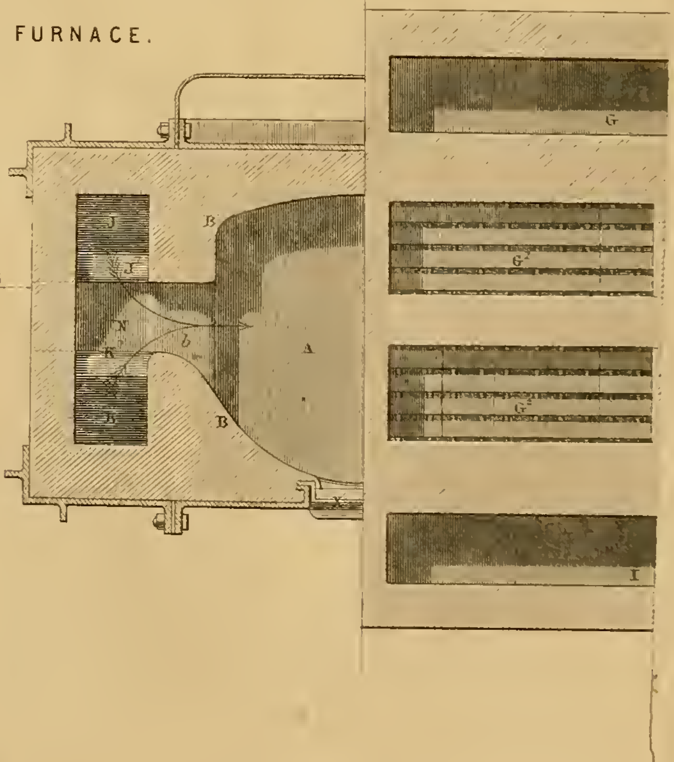


Fig. 6.

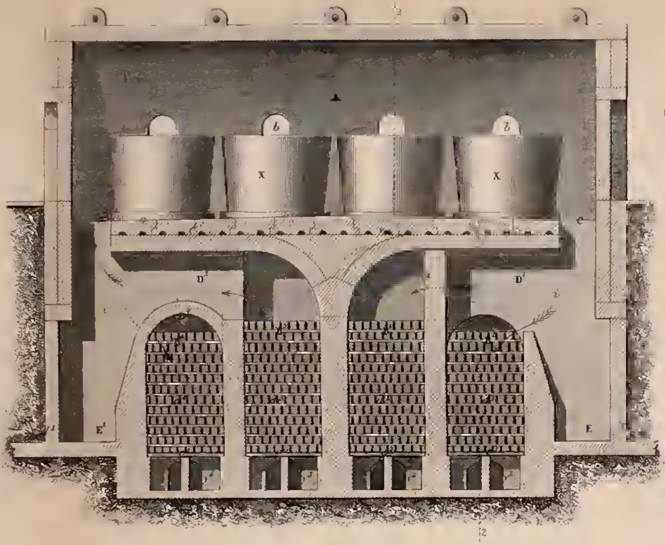


SCALE FOR FIGS. 5 & 6.

REGENERATIVE GAS FURNACES,

BY MESSRS C. W. & F. SIEMANS.
ENGINEERS, Gt GEORGE St.
WESTMINSTER.

Fig. 1.



GLASS FURNACE.

Fig. 2.

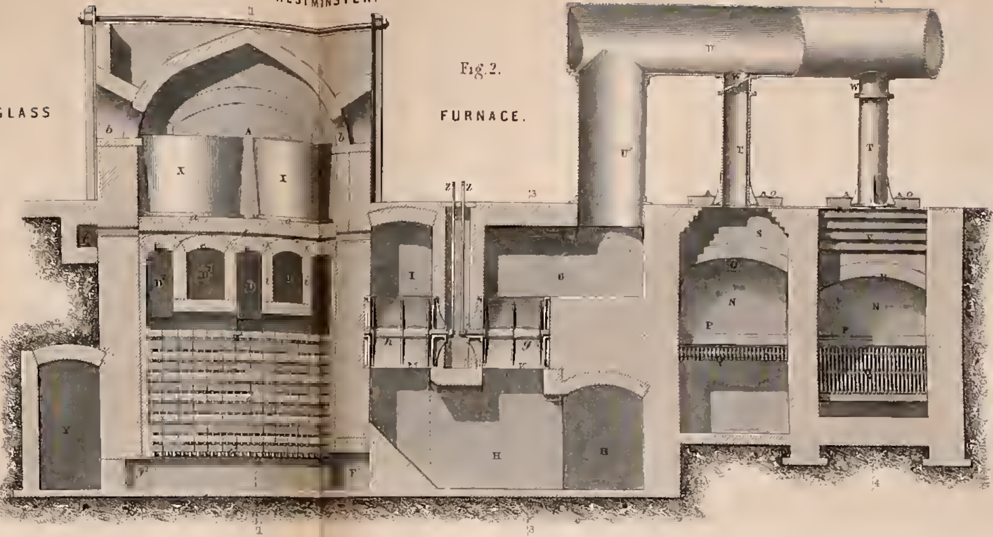


Fig. 4.

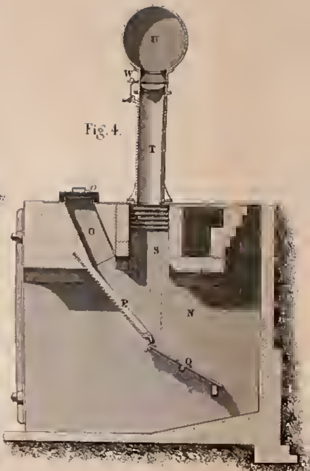


Fig. 3.

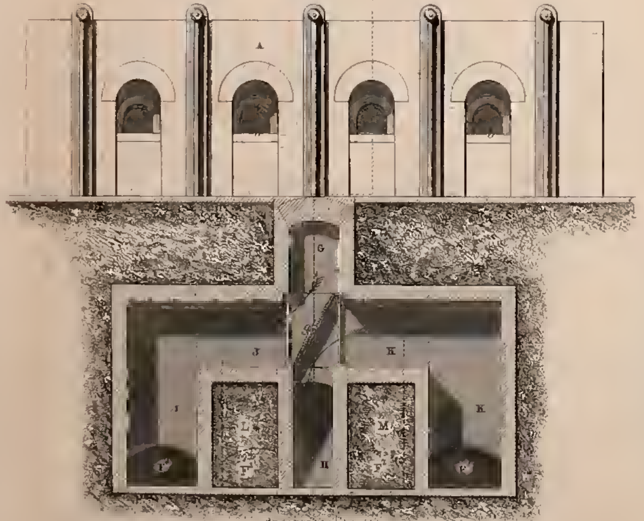
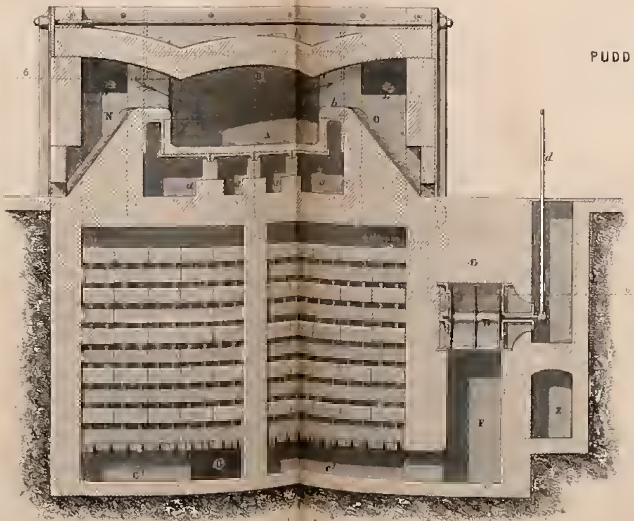
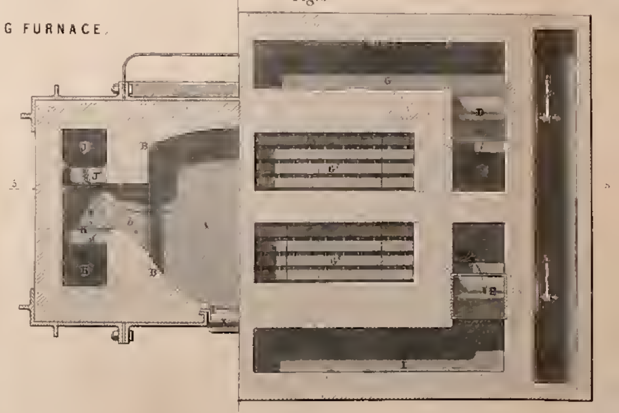


Fig. 5.



PUDDLING FURNACE.

Fig. 6.



SCALE FOR FIGS. 1 TO 4.
INS. 12 6 0 1 2 3 4 5 10 15 20 25 30 FEET.
⅛ INCH = 1 FOOT.

SCALE FOR FIGS. 5 & 6.
INS. 12 9 6 3 0 1 2 3 4 5 10 15 20 FEET.
⅛ INCH = 1 FOOT.

SIEMENS' REGENERATIVE GAS FURNACES.

(*Illustrated by Plate* 284.)

Since the year 1856, improvements in furnaces have occupied the attention of Mr Charles F. Siemens, C.E., and his brother Mr Frederick Siemens. In that year, the latter gentleman patented the first of the series of inventions. This was followed, in 1857, by a second patent by Mr C. W. Siemens, and, last year, a third patent, in their conjoint names, has been taken, which shows the great advances made in their improvements in the interval. Through the obliging assistance of Mr C. W. Siemens, we are enabled to place before our readers working drawings of two principal applications of these arrangements of furnaces to glass making, and to puddling of iron, which we shall presently describe.

The attention of the patentees appears to have been directed to the fundamental principles upon which these important improvements rest, by having, several years since, attempted the practical perfecting of the caloric engine, in which the rarified air, once used, is, by passage through reticulated metallic channels, robbed of part of its heat that would be otherwise wasted, but which is re-absorbed from the metal of these channels by the next portion of air returning through them in a reverse direction. The transition from this, to the original notion, of economising a large proportion of the waste heat of furnaces by analogous means was easy, the advantage certain. If, between any ordinary furnace and the chimney stalk into which the products of combustion are delivered at a temperature of perhaps 2000° to 3000° Fahr., a long flue or a large chamber be interposed, filled loosely or interstitially with any incombustible material, say fire-brick, these contents of the chamber will become heated—they will be hottest at the furnace end, where they will become nearly as hot as the furnace itself, and coolest at the remoter end. If now we have the power, in place of supplying the furnace with cold air, to feed it with air previously passed through this chamber, in a reverse direction to that in which the products of combustion before passed through it to reach the stalk, while the draft is maintained, by the furnace now communicating with the stalk through some other channel, or through a second reticulated chamber, it will result, that the cold atmospheric air, brought into contact first with the coldest part of the reticulated chamber (that next the stalk), and gradually advancing towards the hottest part, next the furnace, will at last arrive at and supply the furnace fire with atmospheric air, which may be almost as hot as the furnace itself.

We have thus as a first consequence, that a large proportion of the heat escaping from the furnace, and in surplus of that which *must* always be wasted, or rather converted into mechanical power, to maintain the draft, will be returned to the fire. But a second result, no less important, follows. The furnace itself, with the same fuel, burns at a higher temperature. The case is to a certain extent analogous to what follows when the cold blast high furnace for iron is fed with hot blast. So far, however, the gaseous products of the ignited combustible itself, at the first moments of their production, are below the temperature of the highest heat of the furnace. One great step more remained to complete the invention fully. If in place of passing the heated air to support combustion through or over solid fuel, in a furnace or on a grate, we can volatilize off at a low temperature, without combustion, the ignitible gases of the coal or fuel, and pass them likewise, through a heated reticulated chamber from the cooler towards the hotter end; and finally, when they, as well as the air that is to support their combustion, are *both* heated to nearly the high temperature of the furnace itself, we mix and ignite the mixture, we shall obtain a body of flame of vastly increased intensity of heat, and we shall economize still more than before. This, in very brief outline, is what Messrs Siemens have successfully accomplished in practice, and, as we shall see hereafter, a vast deal besides; for many of the striking and highly important consequences that follow from this invention are by no means self-evident, or at once perceived.

We shall make the matter most intelligible, however, by first describing the actual arrangements as now in use for the two classes of furnaces —glass and puddling—by reference to our plate 284, and in the words of the specification of 1861 (No. 167).

These improvements relate to that class of furnaces where regenerators are applied to receive the waste heat of the products of combustion, and to communicate the same subsequently to the air supporting combustion. It is an essential part of our invention that the solid fuel used, such as coal, lignite, peat, etc., should be decomposed in a separate apparatus, so that the introduction of solid fuel into the furnace may be altogether avoided, and the gaseous fuel may be heated to a high degree prior to its entering into combustion with atmospheric air, also heated to a high degree, thus causing a great economy of fuel. There is also a great advantage derived from the absence of any solid carbon or ashes in the working chamber of the furnace, by which we are enabled to carry on operations in the open furnace, which it has only been possible hitherto to conduct in covered vessels or pots. We are thus enabled to melt flint. extra white, and other superior qualities of glass in open pots, to fire pottery without enclosing the same in saggers, or to melt steel and other substances upon an open hearth or bed without injury. It is also important in many operations that the state of pressure of the gases in the furnace should be under entire control, and should sometimes exceed, and at other times exactly balance, that of the atmosphere, in order to prevent the egress of flame from, or the ingress of atmospheric air into the furnace on opening apertures for the approach of the workman attending the operation to be carried on, such as blowing glass, puddling iron, etc. For this purpose, we arrange four regenerators below the bed of the furnace, two of which serve to communicate heat separately to the combustible gases and atmospheric air on their way to the furnace, and the remaining two to absorb the waste heat from the products of combustion passing through them indiscriminately before reaching the chimney (their respective action being reversed at intervals), the currents of heated gas and air in ascending through and from the regenerators into the furnace causing a plenum of pressure within the same, which is capable of being modified or regulated by valves for the admission of the gas and air to the regenerators and by the chimney damper. By the same arrangements the chemical qualities as well as the intensity of the flame can be regulated to the utmost nicety. In some cases, where no great heat is required, or where the gas used is very rich in combustible matter, the two regenerators intended for heating the combustible gases may be suppressed and mere passages be substituted, but we generally prefer the four-regenerator arrangement. In order to prevent an accumulation of excessive heat in the arch covering the regenerators, and forming at the same time the support of the furnace bed, we provide chambers between the same for the circulation of atmospheric air. Glass, slag, or other matters that may flow from the bed of the furnace, are made to drop into pockets or chambers on the side of the regenerators, whence they can be readily removed.

In applying our improvements to glass furnaces, we find it sometimes advantageous to melt the materials composing the same in open pots, but to cover them with moveable lids whilst working the metal out in the usual way. When it is required to accomplish secondary operations in separate furnaces, for instance, to heat annealing furnaces or lears in the manufacture of glass, we accomplish this without providing separate regenerators, but by arranging branch channels leading from the upper portion of the four regenerators to the lear or furnace to be heated, where they join in combustion. Dampers of fire clay or other refractory material are provided in that case to these channels to regulate the flow of the gases according to the direction in which the main furnace is working; or we draw off the mixed gases in a state of combustion from the principal furnace. In firing pottery ware, in calcining ores, and other operations, it is required that the furnace charged with these materials, after being heated to the desired degree, should cool gradually and completely before it is charged again. In such cases we propose to provide similar furnaces side by side and only one set of four regenerators, which, by means of slides or valves of fire clay or other refractory material, can be made to communicate at intervals with the one furnace or heated chamber or the other. During the time that one furnace is fired the other is allowed to cool, to be discharged and charged again with fresh material, and vice versa. The regenerators are thus always kept in working condition. Or we arrange four or more chambers in such a way that they themselves are made to contain the materials to be fired, serving alternately as regenerators and as kilns, to be fired or discharged.

Another part of our improvements consists in the particular arrangements of gas generators. It is important that the combustible gasses produced from the fuel should be as rich as possible in hydrogen, carburetted hydrogen, and carbonic oxide, with as little admixture of carbonic acid, nitrogen, and incombustible vapours as may be. The apparatus should be so arranged as to be very regular in its action, and be easily tended and freed from cinders from time to time. It is also important that the gas produced is not drawn through the furnace by the chimney, but that the full atmospheric pressure is maintained in the channels leading from the gas generator to the furnace, lest atmospheric air should be drawn in through crevices, and produce a partial combustion of the gas in the channels, which might be accompanied by a deposition of carbon in the same. This we accomplish in allowing the hot gases to ascend from the generators and to descend again after they have been partially cooled by exposure of the pipes containing them to the atmosphere. The decomposition of carbon is, moreover, avoided by the introduction into the generators, or channels leading from the same, of streamlets of water or of steam, which, in combining with the heated portions of solid carbon, form permanent combustible gases with the same, namely, carbonic oxide and hydrogen. If several generators are provided, we prefer to lead the gases produced by them into a main channel, which may be arranged to supply several furnaces, the advantage of this arrangement being that a greater uniformity in quantity and quality of the gas is obtained.

But in order that our invention may be more easily understood and readily carried into effect, we will now describe the best means we are acquainted with of performing the same, reference being had to the accompanying plate 284.

Figures 1, 2, 3, 4, and 5, on plate I., represent one arrangement of our improved regenerative gas furnace as applied to the manufacture of glass, together with the generator for the combustible gases employed therein. Fig. 1 is a longitudinal section through the furnace and regenerators, on the line 1, 1, fig. 2; fig. 2 is a transverse section through the furnace, regenerators, and gas regenerators, on the line 2, 2, fig. 1; fig. 3 is a section on the line 3, 3, fig. 2, taken through the passages leading from the regenerators to the gas generators and chimney, and also shows the furnace in elevation; fig. 4 shows a longitudinal section through one of the gas generators, on the line 4, 4, fig. 2.

A is the furnace, upon the bed, *a*, of which stand the glass pots, X, apertures, *b*, being provided for working out the glass. Beneath the bed of the furnace are the four regenerators, B^1, B^2, B^3, B^4, each consisting of a chamber built of fire-brick, near the bottom of which is a grating, c^1, c^2, c^3, c^4; upon this grating are piled the fire-bricks or other refractory material, d^1, d^2, d^3, d^4, in such a manner as to leave small interstices between each brick. These regenerators are arched over at the top, and support the bed, *a*, of the furnace. This consists of a number of slabs of fire-clay, or other refractory material, having on their under side small channels, *e*, communicating at one end through the channel, *f*, with the atmosphere, and at the other end with the air passage, I, conducting to the regenerators. A current of cold air is continually passing through these channels, tending to maintain the bed of the furnace, and the arches covering the regenerators, at a low temperature. Communications are established between the top of the four regenerators, B^1, B^2, B^3, B^4, and the furnace, A, in the following manner:—The regenerator, B^1, communicates with the furnace at the point, C, through the passages, D^1, while the regenerator, B^2, communicates with the furnace at the same point, C, through the passages, n^2. In a similar manner the regenerator, B^3, communicates at the point, C^1, with the furnace through the passages, D^3, whilst the regenerator, B^4, communicates with the furnace at the same point, C^1, through the passages, n^4. At these points, C, and C^1, the passages, D^1, and n^2, as also those, n^3, and D^4, are separated from each other by the vertical division walls, *i*, i^1, till they reach the level of the bed, *a*, of the furnace. It will be seen that any glass or other materials falling through the apertures, D^1, D^2, D^3, n^4, from the bed of the furnace will not enter the regenerators, but will fall into the chambers or pockets, E, E^1, at the side of the same, whence they can be removed through the apertures, *l*, l^1, ordinarily kept closed.

Each of the regenerators, B^1, B^2, B^3, B^4, are provided below the gratings, c^1, c^2, c^3, c^4, with openings, F^1, F^2, F^3, F^4; by means of these the regenerators, B^1 and B^4, communicate alternately with the passage, G, leading from the gas generators which will be hereafter described, and with the passage, H, leading to the chimney, whilst the regenerators, B^2 and B^3, communicate alternately with the passage, I, communicating with the atmosphere, and the passage, H, leading to the chimney. These alternate communications are regulated by the reversing valves or dampers, *g* and *h*, in the following manner:—If the valve, *g*, is in the position indicated in fig. 3, then combustible gas from the generator will pass through the passages, J, and will enter the regenerator, B^4, through the aperture, F^4; if, at the same time, the valve, *h*, is in the same position as *g*, then atmospheric air will enter from the passage, I, into the regenerator, B^3, through the passage, L, and aperture, F^3. If the regenerators, B^3 and B^4, have been previously heated by the hot products of combustion passing through them, then the currents of air and combustible gas in passing up through the small interstices between the bricks will become heated to a considerable degree. Arrived at the top of the regenerators, they will be conducted through the passages, D^3 and D^4, to the point, C^1, of the furnace, where, on rising up between the vertical division walls, i^1, they will unite, and on being ignited evolve an intensely hot flame, which passes across the furnace and imparts its heat to the glass pots, X. Arrived at the other end of the furnace, the hot products of this combustion pass downwards through the passages, n^1 and n^2, into the regenerators, B^1 and B^2; here, on passing downwards through the mass of loosely piled bricks, d^1, d^2, these latter absorb the greater part of the heat of the gases, and they issue in a comparatively cold state through the apertures, F^1 and F^2, into the passages, K and M, whence the reversing valves, *g* and *h*, being in the position indicated, they are conducted through the flue, H, to the chimney shaft. When, by the continued passage of the hot products of combustion, the regenerators, B^1 and B^2, have become heated to a considerable degree, the position of the valves or dampers, *g* and *h*, are reversed by means of the levers, Z; combustible gas will now enter into the regenerator, B^1, and atmospheric air into the regenerator, B^2; these currents of gas and air on passing up through the regenerators will become heated to a considerable degree, and on emerging from them at the point, C, will mix, and become ignited, and the hot products of combustion, after traversing across the furnace, will pass down at C^1, through the regenerators, B^3 and B^4, imparting to these the greater part of their heat, and thus each pair of regenerators will alternately serve to absorb the heat from the products of combustion, and then give off this same heat again to the gas and air serving to produce this combustion. A passage, Y, is provided at the side of the regenerators for obtaining access to them through the openings y^1, y^2, y^3, y^4.

The combustible gases are produced in a series of gas generators, N, by the imperfect combustion of fuel. In these gas generators the fuel is introduced through the hoppers, O, kept closed by means of the covers, *o*; from these hoppers the fuel descends on to an inclined plane, P, of fire-brick or other refractory material, which may be inclined about 45 degrees; thence the fuel passes on to the fire-grate, Q, which should be inclined about 30 degrees. Over this grate, but at a sufficient height from the same to allow a deep layer of fuel to intervene, is an arch of fire-brick, R. This arch, being once heated to a considerable degree by the fire on the grate, radiates heat on to the fresh combustibles as they pass down the inclined plane, P, and thus causes their partial decomposition and volatilization, which is afterwards completed by the atmospheric air which enters through the grate, Q. This air, on passing through the layer of highly heated fuel lying upon the grate, is first decomposed into carbonic acid gas with a certain proportion of nitrogen, and afterwards, on passing up through the thick layer of fuel in a less state of incandescence, it becomes transformed into carbonic oxide, and in this state passes over the surface of the fresh fuel on the inclined plane, P, where it mixes with the gases evolved from the same, and then passes up through the passage, S, into the vertical pipe, T, and from this into the horizontal pipe, U, which establishes a communication between all the gas generators and the regenerators, B^1 and B^4. This pipe descends again at U^1, where it joins on to the flue, G, by which means the column of gas in the pipe, U^1, being somewhat cooler, and consequently more dense than the column of gas in the pipe, T, a sufficient draft is maintained without the gases in the flue, G, having to be drawn through by the action of the chimney, and thus a plenum of pressure is maintained in these passages so as effectually to prevent atmospheric air entering into them through fissures, and causing a partial combustion of the gases.

An aperture, V, is formed in the top of the generator for the purpose of stirring the fuel from time to time. Valves, *w*, are provided in the pipes, T, of each gas generator so as to shut off the communication with any one of them when not in use or under repair. A small water supply pipe is provided with little branches and taps for admitting a small driblet of water into the gas generator through a funnel on the pipe, T; this small current of water passing along the side of the pipe, and falling partially on the body of the fuel, becomes vapourized, and the vapour thus formed acting upon any hot particles of carbon rising up with the gases, combines with the same, forming two combustible gases, namely carbonic oxide and hydrogen.

In the improved regenerative gas furnaces for glass we sometimes dispense with the use of pots altogether, and place the materials to be melted on the bed of the furnace itself, which is then made of a certain depth.

In figures 5 and 6 is shown a construction of our improved regenerative gas furnace adapted for the purpose of puddling iron.

Figure 5 shows a longitudinal section on the line, 5, 5, in fig. 6; figure 6 shows a sectional plan above the bed of the furnace, and a sectional plan of the regenerators on the line, 6, 6, in fig. 5.

The bed, A, of the furnace, B, is made of a considerable depth, and is constructed of iron covered with fire-brick or other refractory material. Below the bed, spaces, *a*, are provided for the circulation of cold air. Beneath the furnace are the regenerators, C^1, C^2, C^3, C^4, constructed in a similar manner to those already described. By means of the reversing valves or dampers, D, E, actuated by the levers, *d*, *e*, the regenerators, C^1 and C^3, are made to communicate alternately with the gas generators through the passages, F and G, and with the flue, Z, leading to the chimney, whilst the regenerators, C^2 and C^4, are made to communicate alternately with the atmosphere, through the passages, H and I, and with the chimney, through the flue, Z. Thus, if gas is entering at the bottom of the regenerator, C^3, and atmospheric air is entering at the bottom of the regenerator, C^4, they become heated on passing through the masses of loosely-piled bricks; arrived at the top, they pass up through the passages, J and K, and into the furnace through the side openings, J^1, K^1; here they unite, and on being ignited, heat the furnace to the required extent, the hot products of combustion traversing across the furnace, and then passing through the side openings, L^1, M^1, into the passages, L, M, and then down into the two regenerators, C^1, C^2, in the manner as already described with reference to other arrangements. The apertures, J^1, K^1, L^1, M^1, leading from the regenerators into the furnace, are here, with advantage, constructed in the side of the same, instead of in the bed, as in the before-described arrangements. This allows of channels, N and O, being formed between them, leading from the bridges, *b*, down to the small openings, *c*, through which cinders and other impurities are removed from the furnace. A door, X, is provided, as usual, in the side of the furnaces for working the iron.

Having now described the nature of our invention, and the best modes we are acquainted with of performing the same, we wish it to be understood that we do not confine ourselves to the precise details shown on the accompanying drawings; but we claim as our invention the various arrangements of regenerative furnaces worked by the gases resulting from an imperfect combustion of solid fuel in separate places, as hereinbefore set forth.

Such arrangements of furnaces are applicable, with the greatest relative advantage, in cases where great heat has to be maintained, as, for instance, in melting and refining glass, steel, and metallic ores, in puddling and welding iron, in heating gas and zinc retorts, etc The fuel used for working these furnaces, which may be of the most inferior description, is separately converted into a crude gas, which, in being conducted to the furnace, has its naturally low-heating power enormously increased by being heated to very nearly the high temperature of the furnace itself, undergoing at the same time certain chemical changes favourable to the generation of heat in its subsequent combustion. The heating effect produced is still further increased in consequence of the air necessary for combustion being also heated separately to the same high degree of temperature (ranging to about 3000° Fahrenheit) before mixing with the heated gases in the combustion chamber or furnace, which latter is filled with a pure and gentle flame of equal intensity throughout the chamber. The heat imparted to the gas and air before mixing is obtained from the product of combustion which, after having fulfilled their office in the furnace, are reduced to a temperature frequently not exceeding 250° Fahrenheit on reaching the chimney. It is evident that great economy of fuel must, among other advantages, be the result.

Besides the conditions of economy due to the regenerator, referred to by us at the commencement, one altogether different is now superadded. Siemens' furnace is a gas furnace; the fuel is not the crude solid stuff usually shovelled in or mechanically fed into the furnace close to the focus of heat. The gases from the solid fuel are made elsewhere, and the pure gaseous matter evolved, is conducted to the focus, and there mixed with the equally heated air, becomes the real fuel employed. In the immediate neighbourhood of Birmingham, the glass house of Messrs Lloyd & Summerfield, constructed upon this plan, has now been in continuous operation for nearly a twelvemonth, and affords an excellent opportunity for ascertaining the consumption of fuel of the regenerative furnace, as compared to that of its predecessor performing the same work. At the important glass works of Messrs Chance Brothers & Co., the regenerative gas furnace has been under trial for the same length of time, and has latterly been carried into effect for the various purposes in crown and sheet glass making upon a gigantic scale. Messrs Russell & Co. are extending the application of the same principle of furnace construction to the delicate operation of welding iron tubes, having made their arrangements upon such a scale that before very long solid fuel will, in all probability, be banished from their works. Another flint-glass furnace, erected by Messrs Gibb Brothers, and one by Mr Richard Smith, on behalf of the Earl of Dudley, at the Round Oak Works, are amongst the latest applications of the regenerative gas furnace.

The gas producers of some of these furnaces hold as much as ten tons of crude fuel; and the mode of production of the gases from it is as follows:—The fuel in descending slowly on the solid portion of the inclined plane already referred to, becomes heated, and parts with its volatile constituents, the hydro-carbon, water, ammonia, and some carbonic acid, much the same as if it were in a gas retort. This being accomplished, there remains from 60 to 70 per cent. of purely carbonaceous matter to be disposed of. For this purpose, a slow current of atmospheric air now sets in upon the fuel producing regular combustion immediately upon the grate, but the carbonic acid produced by this combustion having to pass slowly on through a layer of incandescent fuel, from three to four feet in thickness, takes up another element of carbon, and the carbonic oxide thus formed passes off with the other combustible gases to the furnace. For every cubic foot of combustible carbonic oxide gas thus produced, taking the atmosphere to consist in 100 volumes—

Of 20 vols. oxygen,
and 80 vols. nitrogen,
—
100

two cubic feet of nitrogen of the atmosphere, pass also through the grate, tending greatly to diminish the richness or heating power of the gas. The whole of the carbonaceous portion of the fuel is not, however, volatilized on such disadvantageous terms, the water trough at the foot of the grate absorbing the spare heat produced in the combustion, emits steam through small apertures, x x, under the lid, which steam, in traversing a layer of from four to five feet of incandescent fuel, is decomposed into a mixture consisting (for every cubic foot of steam supplied) of one cubic foot of pure hydrogen, and nearly an equal volume of CO with a variable small proportion of CO_2. Thus one cubic foot of steam yields as much inflammable gas as five volumes of atmospheric air, but the one operation is dependent upon the other, inasmuch as the passage of atmospheric air is accomplished by generation of heat, whereas the production of the water gases, as well as evolution of the hydro-carbons, are carried on at the expense of heat. The generation of steam in the trough being dependent on the amount of heat in the fire-place, regulates itself naturally to the requirements, and the total production of combustible gases rises and falls with the admission of atmospheric air. Or, since the admission of this into the grate depends in its turn upon the withdrawal of the products of partial combustion, it follows that the demand for combustible gases regulates entirely their production. The production of gas may even be entirely arrested for twenty-four hours without deranging the producer, which will recommence its operation immediately, when the gas valve of the furnace is re-opened, the mass of fuel and brickwork composing it being sufficient to maintain a dull, red heat during that interval. The gas produced is more uniform in power in proportion as the demand is more completely continuous; so that it is found preferable even to supply several furnaces with gas, from one gas producer.

By an extension of this principle, it is obvious that in a great and systematically-arranged manufactory of any sort, applying furnace heats at many points, all the gases for combustion will best be made at one, or a very few points; and it even follows, that over large areas of a manufacturing district, thickly occupied, the gaseous fuel for very many works may be produced at one point, where the gross fuel is cheapest, and the carriage least; and the gases for all, brought to their respective points, for being heated and burnt, through large mains, which, as they will have scarcely any pressure on them, may be mere brick culverts or drains.

The arrangement by which the invention maintains a slight *plenum* in the gas flue bringing the produced gases to the furnace is highly ingenious. It is seen in our figs. 1, 2, and 3, and the principle of action is as follows:—The compound gases on leaving the producer have a temperature ranging between 300° and 400° Fahrenheit, which represents an amount of heat that must, under all circumstances, be sacrificed; for the action of regenerators is such, that it makes no difference to the result at what temperature the fluid to be heated enters the same—the final temperature being in all cases that of the focus, or say 3000° Fah. The heat is made available for producing a *plenum* of pressure by making the gas rise, say 20 feet, then carrying it horizontally 20 or 30 feet all through a thin wrought-iron tube, and letting it again descend on the way to the furnace. The horizontal pipe being exposed to the atmosphere, causes the gases to lose from 100° to 150° of temperature, which increases their density from 15 to 20 per cent., and gives a preponderating weight to that extent to the equal *descending* column, urging it forward. This cooling might be promoted farther, if desirable, by wetting the exterior of this iron flue, and employing the steam produced in the producing furnace. The inventor has, however, not proposed this.

The gases proceeding from the producers consist, as before shown, of a compound of olifiant gas, light carburetted hydrogen, the vapours of tar, water and ammoniacal compounds, hydrogen gas, and carbonic oxide, besides nitrogen, carbonic acid, and some sulphuretted hydrogen. The specific gravity of the compound averages 0.78 (air being 1), so that a ton of fuel—not including the earthy remains—produces nearly 64,000 cubic feet of gas. In heating these gases to 3000° Fah. their volume will be fully six times expanded, but in reality a much larger increase of volume ensues, in consequence of some important chemical changes occurring at the same time. Olifiant gas and tar vapours are well known to deposit carbon in being heated to redness, which carbon is immediately taken up by the carbonic acid, and vapours of water—the former being converted into carbonic oxide, and the latter into carbonic oxide and pure hydrogen. The ammoniacal vapours and sulphuretted hydrogen are also decomposed, and permanently elastic gases, with a preponderance of hydrogen, formed. The specific gravity of the compound is reduced, in consequence of these transformations, to 0.70, giving an increase of volume from 64,000 to 75,000 cubic feet (taken at the same temperature) per ton of fuel. This chemical change represents a large absorption of heat from the regenerator, which, however, will be redeveloped in combustion, thus enhancing the heating power of the fuel, beyond the increase due to elevation of temperature.

The amount of directive power to the requirements of manufacture, thus conferred upon the gasified fuel it is easy to see. Not only can we at will, by varying the proportions, produce oxidizing or reducing heat, but we have heat, as it were quintessentialized, freed from all dust, soot, ashes, &c., and further, freed from the injurious action of sulphur.

The chemical transformation of the gases in the regenerator prevents, to a great extent, the injurious effects of sulphur, because the sulphur, in separating from the hydrogen, will, it may be supposed, take up oxygen (supplied by the carbonic acid and water), and form sulphurous acid. This view is so far borne out by experience, that glass containing a moderate proportion of lead in its composition may thus be melted in open crucibles without injury; but in dealing with the highest quality of flint glass, it is found necessary to retain covered pots. Every other description of glass is, however, melted in open pots, and here saving of fuel is of comparatively small moment to the improvement effected in the colour and general quality of the glass, owing to the absence of dirt and ashes, and the higher degree of temperature which may with safety be maintained throughout the furnace.

We have no interest other than the promotion of applied science, in expressing our conviction, that this invention is yet destined to work changes and ameliorations, in our manufactories using furnace heat, of the most enlarged and important character. Its direct and immediate effects are obvious. It gives the power of effecting in open furnaces, and upon the grandest scale, operations of calcination, reduction, fusion, welding, &c., previously only possible under narrow limits, or the restraints of enclosed vessels. It may become, to all the subsequent processes of iron-making, from the crude pig to the finished bar of wrought iron or steel, more than what the hot blast has already been, to the smelting furnace under the older system, and with this in addition, that the injurious ingredients of even the worst coal fuels may become so innocuous to the quality of the metal that our iron may once more rival or surpass the charcoal bars of other days.

Many other special directions of prospective advantage might be alluded to did space permit. But one more, and perhaps the greatest, must not be passed over. For furnaces of this kind, as we have seen, the quality of the fuel is absolutely indifferent—as intense a heat may be produced by the use, as gas-producing fuel, of the worst "breeze" or "culm," lignite or peat, or even schale that can scarcely be got to burn at all, from its immense content of ash, as by the finest Newcastle coal. There is with any fuel, however bad, in fact, no limit to the temperature that may be produced, but the theoretic one, namely, the maximum heat that an atom of carbon in combining with oxygen can evolve. It must result from this that, in districts such as South Staffordshire, where the thick seams of coal are nearly cut out, only about 40 years' consumption remaining at the present rate, but where plenty of small bad coal and thin seams still exist, a new start in the race of prosperity can be conferred, and that many heat-demanding manufactures hitherto denied a possible existence in lands devoid of coal, such as Ireland practically is, may be engaged in.

Bricks are everywhere of the very worst quality in Ireland, and though surrounded with peat bogs, are still burnt with sparsely supplied "culm," coarse pottery for home consumption, glass bottles, now scarcely able to exist, as a manufacture with coal fuel in Ireland, all may spring into existence, and flourish, with peat as fuel, or rather as the means for producing fuel; and a greater end perhaps than all remains. Dr Percy, in his metallurgy, informs us that, at two collieries in South Staffordshire alone, 160,000 tons of small coal are annually wasted and thrown away for want of any possible use for such refuse fuel, while good statistic authorities inform us that, at the present day, we are raising and either burning or exporting three hundred million tons of coal per annum from our coal-fields, and wasting, as above, fully a hundred millions more. Our national stock is truly great, but not infinite or inexhaustible. Siemens' furnaces offer the means of future husbanding of it, to an extent beyond calculation. Should the future prove these suggestions actual realisations, this invention must become classed amongst those upon which the prolongation or the increase of national wealth and power have depended.

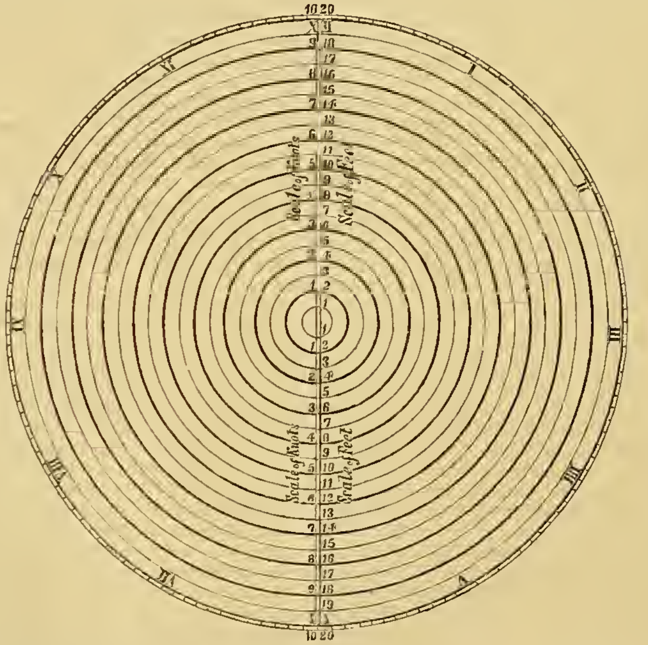
GALBRAITH & HAUGHTON'S TIDAL CLOCK CARD.

RULE I.

By Profs. Galbraith & Haughton.

To find the tidal drift of a vessel between two given hours, on a given day, in a given part of the Irish Sea, or English Channel.

1. Find the time of high water at head of tide.
2. Find from this time, and the two given hours, the tidal hours corresponding to them.
3. Draw from these tidal hours, on the card, radii to intersect the circle, whose radius is DOUBLE the rate in knots, given in the Admiralty charts or tide tables.
4. From the points of intersection so found, let fall perpendiculars on the diameter; the intercept between the feet of these perpendiculars, measured on the scale of knots, is the amount of tidal drift required.



RULE II.

By Professor Airy, Ast. Royal.

To find the CHANGE OF LEVEL of the sea, between two given hours, on a given day, in a given place.

1. Find the time of high water at the place.
2. Find from this time, and the two given hours, the tidal hours corresponding to them.
3. Draw from these tidal hours, on the card, radii to intersect the circle, whose radius is HALF the range of tide in feet, at the given place, on the given day.
4. From the points of intersection so found, let fall perpendiculars on the diameter; the intercept between the feet of these perpendiculars measured on the scale of feet, is the change of level required.

We reproduce here, by permission of the authors, the Tidal Clock Card of Professors Galbraith and Haughton. It forms the sequel to their "Manual of Tides and Currents," reviewed in this part. The use of the Tidal Clock to the navigator of our narrow seas is to enable him at any moment to ascertain, not only what drift his ship may have sustained by reason of tidal stream, but also what absolute change of level by rise and fall of tide—how much nearer or farther off with respect to the bottom the ship is, than at some anterior period of tide; or how far off the bottom she will be, at any place when the soundings are given, at any future period of tide. Thus, if a ship is laying off and on nearing the port of Liverpool, and deep laden, so that the master knows he will not at the top of spring tide have more say than 2 feet water to spare to enable him to get in over the cill of Duke's Dock, and he wishes to know, if he runs in at once, whether in the then state of things as to tide he shall have water to enter the dock: the Clock Card and the Nautical Almanac will give him all the information he needs for assurance and safety.

The second piece of information above must come first, from the use of Rule II., given by Professor Airy, and based upon the curious result, that the rise and fall of tide in our channels being represented by uniformly equal units of the vertical diameter of a circle, the times of equal rise and fall will be found in hours upon the equally divided semi-circumference of the same circle. This rule which upon the tide card requires only a parallel rule to work, being first applied, the Rule I., comes into play, by which the tidal drift of a vessel within any two given hours can be ascertained; and hence the difference between the ship's place, as given by her reckoning, and her true place assigned.

MATERIALS FOR PAPER MAKING.

So long ago as 1772, no less than sixty distinct substances had been tried, and with such success as to have been actually made into paper, and yet different from flaxen rags—all by one man—as appears by a book now in the British Museum containing the whole collection; and from that day to a recent one, many additions have been made by the inventive ingenuity of others to this extensive catalogue. Rag, however, still is king. No good substitute yet has been found for the fibre of flax or of cotton cloth that has passed through the ordeal of constant friction and plication upon the human frame—of years of moderate warmth and moisture, and of the innumerable submittings to alkali, soap, and water, that are the lot of every garment before it has waxed old, and has been discarded. Yet we will not believe but that the paper material problem is still capable of solution—that it is possible to find ready-made native grown fibres, that by suitable but rapid preparation should make as good paper as any rags. We strongly think that it is one of the problems that no man has yet even approached in a truly philosophical spirit, and aided by all the necessary preliminary knowledge, of the naturalist, the chemist, the microscopist, and the practical paper-maker combined. We think so the rather that, when you ask any paper-maker *why* it is that rag alone answers him, and demand *how* it is that their fibres differ from those of many native ligneous tissues of analogous plants—say any of the urticas or spartiums, &c.—he is unable to give you any clear or definite answer; and all the information that can be collected on the subject amounts to little more than that the fibre suitable for paper must have a "corrugated edge," *i.e.*, a serrated edge, so as in fact to constitute a material susceptible to a moderate extent of being "felted."

While, however, rags have carried the day, as the *sine qûa non* of the paper maker, he has achieved this at least, that he has found two materials that may be mixed in large proportions with them to give body, if not toughness, to his paper. The first of these is straw, now known and in use for a considerable time, and more largely used in Ireland than elsewhere for newspaper paper, owing to the native cheapness of the material there, and its bulk in carriage rendering it dear elsewhere. Indeed, attempts have been made in Ireland to press straw into blocks, and send it to England in that state for paper-making, but so far without commercial success.

This material is, however, incapable of making paper unaided by rags: as much as 30 per cent. of straw pulp can be added for some paper. The straw is boiled in a large volume of solution of caustic soda to remove the siliceous epidermis, and heated with chlorine for the finer white paper, and finally with a more concentrated caustic alkali usually before being put into the rag engine with the rag pulp. The waste upon a given weight of straw is enormous. So much so, that if, regardless of qualities, two papers were made—one of all straw and the other of all rags—they would cost alike, although the raw material weight for weight was in the rags eight times as dear as in the straw. The pulp—for fibre it cannot be called—produced from the straw is a mere filling stuff to thicken and make heavy the paper: it is alone, almost quite devoid of all toughness or cohesion.

Another material has long been proposed as an adjunct to rags, but has only latterly really got into use, namely, wood pulp. At this moment, however, there is a steady trade of import, of wood pulp into this country from Belgium, for the use of our paper makers; and a great consumption of a product that certainly might employ waste water-power and peat fuel in many an idle corner of Ireland or Scotland just as well.

There are two processes by which wood has been converted into paper material: one may be called the chemical, the other the mechanical process. The first is very analogous to that by which the straw is prepared by heat, high pressure or super-heated steam being also employed to separate the wood fibres and assist in softening them. In the other, the wood is simply rasped down by grindstones moving in water and acting across the grain of the wood, until the whole is reduced to a mass of longish saw-dust in a wet state. In both processes, chlorine is applied to whiten the wood.

The Belgian process, though acting under a brevet, is kept very much a secret, and is believed to be a combination of both methods. It is conducted at the mills of Mount Guibert, belonging to Mons. De Coste; and the pulp is shipped at Antwerp at about £20 per ton. As much as 30 per cent. of it can be mixed with printing paper, and from 5 to 10 per cent. with tissue paper. The paper upon which the *Daily Telegraph* and *Reynolds' Miscellany* are printed are thus mixed with this material. Seen in mass, it is of a very light cream white, and suggests the idea that it is made chiefly from woods of the Tiliacceœ—limes, or from willows or alders.

Now that the paper duties repeal has left the same scope to the paper maker that Sir R. Peel's memorable repeal of the glass duties did for the glass manufacturer, we may expect to find some decided advances; and amongst the rest, to find the French method of adapting old tarred rope and junk, to brown and grey paper making, or even to white papers, brought into use; and peat, the use of which for paper making was years ago shown to be practicable, brought largely into use for lapping papers, for millboards, and for papier maché—especially for those coarser and thicker sorts that would be most suitable to form into ornaments in basso relievo, like those of Bielfield and of Bassano.

ARSENIC POISONING BY PAINTS AND COLOURS.

The subject of arsenic poisoning, more or less complete, attributed to the green paints or distemper colours of room papers, and many other materials in common use, has, from time to time, of late years, excited so much attention, and been the subject of so much doubt and controversy, that we are glad to be able to transfer to our pages the following important and clear communication by Professor Hofmann, F.R.S., of the Royal College of Chemistry, London, addressed to the Right Hon. William Cowper, in reply to inquiries forwarded, in his official capacity, to Dr Hofmann. That eminent chemist's statements are decisive, as to the much-disputed fact of the *existence* of arsenic in the green colours of common use, or in some of the brightest of them.

The doubts raised at various times, as to the fact, are, most probably, explicable by the fact, (which, however, we have not seen noticed elsewhere) that great quantities of green colours are found in commerce, under the *names* of "Scheele's green," and "Schweinfurth green," that consist merely of chrome yellow, sulphate barytes, and Prussian blue, intimately mixed together, and which, purchased under the supposition that they are what they are called, yet prove on examination to contain no arsenic:—

"Royal College of Chemistry, January 25, 1862.

"Dear Sir,—In accordance with your wishes, I have examined carefully the green colouring matter of the artificial leaves from a lady's head-dress which you have sent me.

"It is well known that such leaves generally contain arsenic, and often in considerable quantities. An experienced eye readily recognises the presence of an arsenic colour (Schweinfurt green) by its brilliancy, the intensity of which is as yet unrivalled by any other green. However, should there remain the slightest doubt, an experiment of the simplest kind would establish the fact. In most cases it would be sufficient to burn such a leaf in order at once to perceive the garlic odour which characterises the presence of arsenic.

"In a dozen of the leaves sent me, analysis has pointed out on an average the presence of ten grains of white arsenic. I learn from some lady friends that a ball-wreath usually contains about fifty of these leaves. Thus, a lady wears in her hair more than forty grains of white arsenic, a quantity which, if taken in appropriate doses, would be sufficient to poison twenty persons. This is no exaggeration, for the leaves which you have sent me were, some of them at least, only partly coloured, others only variegated. In consequence of your inquiries, I have been led lately to pay more than usual attention to the head-dresses of ladies, and I observe that the green leaves are often much larger and more deeply coloured than those which I received.

"The question, how far arsenic-dyed wreaths may be prejudicial to health is intimately connected with the discussion, so frequently raised of late years, as to the influence which arsenic-coloured paper-hangings exert upon the human system. This influence has been doubted on various grounds, both by the chemist and the physician. The alleged effect has been attributed to the development of arsenietted hydrogen, or some other volatile arsenic compound, to which the white arsenic, by the action of the damp of the wall, or of the organic constituents of the vapour and the paste, might possibly have given rise. Accurate experiments, however often repeated and often varied, have proved the inadmissibility of the assumption of gaseous arsenic exhalations, and, as it so often happens, the injury was denied simply because it could not be explained. Nevertheless, the deleterious effect of arsenic green paper-hangings is at present pretty generally acknowledged. Indeed, it does not require any high-flown hypothesis to explain the transfer of the arsenic from the wall to the system. The arsenic dust, bodily separated from the wall and dispersed over the room, is quite sufficient for this purpose. The investigations of the last few years have clearly shown the presence of arsenic in the dust of rooms hung with arsenic-green paper, even when this dust had been collected at the greatest possible distance from the walls. Moreover, the chronic poisoning by arsenic of persons living in such rooms has been proved experimentally, inasmuch as the presence of arsenic may be demonstrated in their secretions, more especially if the elimination of the poison be accelerated by the administration of iodide of potassium.

"The employment of arsenic-green in the manufacture of paper-hangings, in staining paper, in painting children's toys, etc., has attracted the attention of the sanitary authorities on the Continent for many years past. In several of the German States, more particularly in Bavaria, the very country of arsenic colours (which are manufactured on a very large scale in Schweinfurt, a town in Franconia), the application of these colours to papering or painting rooms has been repeatedly proceeded against. I have before me an edict of the Bavarian Government of the 21st of July, 1845, expressly prohibiting the manufacture and sale of arsenic-green paper-hangings. This general prohibition, it is true, was repealed by an Act of the 23d of January, 1848, 'for industrial considerations,' and the use of Schweinfurt green permitted as before for house papering and painting, provided the colour were permanently fixed by appropriate means. The relaxation of the measures against Schweinfurt green appears, however, to have given but little satisfaction. In several papers laid, both by chemists and physicians, before the Academy of Munich, in its sitting of the 9th of June, 1860, undoubted cases of chronic poisoning produced by arsenic papers, even when glazed, were brought forward, and the Academy was called upon to represent to the Government the necessity of strictly enforcing the former regulations against arsenic colours, and of removing all Schweinfurt-green wall colouring from public buildings, schools, hospitals, etc.

"The immense consumption of arsenic colours, and their reckless use under various conditions prejudicial to health, certainly claim the especial notice and the consideration of the public. Not satisfied with poisoning the wreaths which adorn the heads of our women, modern trade introduces arsenic without scruple even into their dresses. The green tarlatanes so much of late in vogue for ball dresses, according to an analysis made by Professor Erdmann, of Leipsic, contain as much as half their weight of Schweinfurt green. The colour is loosely laid on with starch, and comes off by the slightest friction in clouds of dust. I am told that a ball-dress requires about twenty yards of material—an estimate probably below the mark, considering the present fashion. According to the above analysis, these twenty yards would contain about 900 grains of white arsenic. A Berlin physician has satisfied himself that from a dress of this kind no less than sixty grains powdered off in the course of a single evening.

"It will, I think, be admitted that the arsenic-crowned queen of the ball, whirling along in an arsenic cloud, presents, under no circumstances, a very attractive object of contemplation; but the spectacle, does it not become truly melancholy when our thoughts turn to the poor, poisoned artiste who wove the gay wreath, in the endeavour to prolong a sickly and miserable existence, already undermined by this destructive occupation!

"Ladies cannot, I think, have the remotest idea of the presence of arsenic in their ornaments. If aware of their true nature, they would be satisfied with less brilliant colours, and reject, I have no doubt, these showy green articles, which have not even the merit of being, as far as colouring is concerned, a truthful imitation of nature. There being no longer a demand for them, the manufacture of poisonous wreaths and poisonous dresses would rapidly cease, as a matter of course.

"I remain, dear Sir, yours very sincerely,
"A. W. HOFMANN.

"To the Right Hon. William Cowper, &c."

Professor Hofmann disposes of the cloud of difficulty that has been raised in debate, as to *how* the arsenic from arsenio-cupric colours gets into the animal system, in a manner as simple as it is convincing. We breathe, not arsennieuretted gases, but arsenical dust—sixty grains shaken off from a lady's dress in one night! Some modified legal control over deadly trades, like that of these poor artificial flower-girls, analogous to that exercised in France over "les metiers insalubres," would be an unmixed good. Public health is enforced by law in many other directions, why not in this? We prohibit, except under safe-guards, the *sale* of arsenic in bulk, why not prohibit its sale attached to articles of furniture, habitations, or dress—it is not there by any necessity.—Ed.

RECENT PATENTS.

STEREOTYPING.

John Napier, *Edinburgh.—Patent dated June* 12, 1861.

The improvements specified under these letters patent have reference to certain modes of obtaining stereotype plates, which possess many advantages over the ordinary plaster or paper processes.

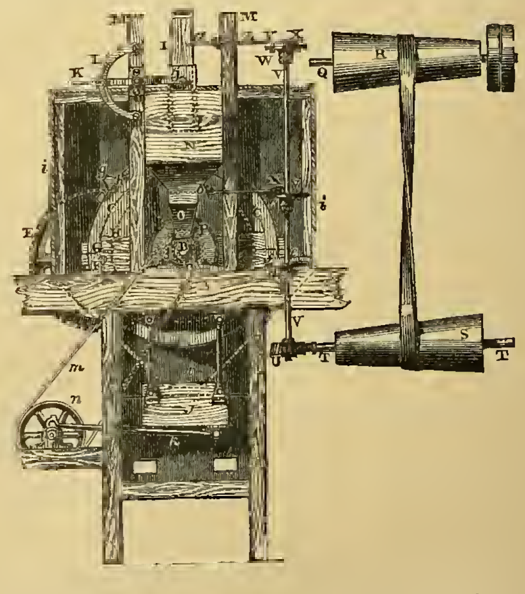
Under one mode of proceeding, a cast iron plate is prepared for receiving the plaster, or other suitable material, used in the process. The surface of the iron plate is rendered smooth by planing, or other equivalent means, and a sheet of cartridge, or other paper, is pasted on to the surface of the plate. A coating of paste is also laid on the surface of the paper; and the operator having prepared a sufficient quantity of plaster-of-paris, or other suitable plastic material, mixed with water, or other fluid, to the consistence of thick cream, this mixture is poured on to the plate, and its surface is levelled by means of a straight edge, or other suitable tool. The "form" containing the matter to be stereotyped is properly "locked up" in the usual way, and the surface of the type, or the blocks, is slightly oiled, to prevent the plastic material adhering thereto. The form is then inverted, and laid, with its face downwards, upon the plaster, and is allowed to remain there until the plastic material has completely solidified. When this is effected, the form is removed from the plastic material, and the cast is dried by the application of heat. This may be conveniently accomplished, either by means of a large-sized type-founder's furnace, or by an oven suitably arranged for the purpose. A flat cast iron plate is covered with paper, and is then screwed, or otherwise fastened to the plate which has the dried matrix upon it. The duplex plates thus arranged form the mould for obtaining the metal stereo-cast; and in order to regulate the thickness of the metal forming the stereo-cast, the second plate is furnished with gauges, so as to keep the plates a proper distance asunder, and so insure a suitable and uniform thickness of metal in the stereotype plates. The duplex plates forming the mould are well-heated in the oven, and the metal for casting the stereotype plate having been previously melted, it is poured in between the plates by means of a lip, or other suitable opening, formed for the admission of the molten metal. Another mode of effecting the process of stereotyping, which is suitable for small-faced type and woodcuts, is to prepare a sufficient quantity of the plaster, or plastic material, and to fill the interstices between the letter with it, so as to completely cover the surface. The plastic material is pressed down, either by means of a flat surface, covered with a soft material, or it is done by means of a roller. The prepared plate, covered with paper, is laid upon the plaster, which is then allowed to solidify. The plate and form are then turned over, and the form is lifted off. After the matrix has been dried, the top or mould plate is fastened to the lower plate, and the two are heated prior to pouring in the molten metal. In cases where the paper used for covering the plates, in these processes of stereotyping, are subjected to a high temperature, it is convenient to prepare the paper prior to using it for the plates, in a saline solution, so as to render it non-inflammable, or nearly incombustible. When the metal which was poured into the mould has cooled, the stereo-cast is removed from the mould, and the plate is finished by planing or chipping away, if necessary, any irregularities of surface. The plate, when mounted upon wood in the usual manner, is ready for the printer. These modes of stereotyping are not injurious to the letter, or the woodcuts, as the beating is dispensed with, and the rough usage consequent thereon is avoided. The processes are, moreover, more economical than the ordinary system of casting in plaster, and effect a saving of time as well as wear and tear.

BARLEY AND RICE MILLS.

A. W. Gibson, *Belfast.—Patent dated June* 18, 1861.

This invention relates to the arrangement and construction of machinery or apparatus for grinding or manufacturing barley or rice; and the improvements are based, to a certain extent, upon an invention of a somewhat similar kind, for which letters patent were granted to the patentee, dated April 28, 1854.

The accompanying engraving represents an elevation of a barley or rice mill arranged according to this invention, and having the several improvements applied thereto. The mill is supported on the horizontal beams, A, which are arranged parallel to each other; on these beams are fitted the pedestal bearings of the main driving shaft, B. On this shaft is a pulley which is driven by means of an endless belt deriving its motion from any convenient prime mover. The shaft, B, is squared at the central part, on which is fitted a vertical grinding stone of the ordinary kind. The stone is fitted within a casing, C, to which rotatory motion is given, but at a reduced velocity. Keyed on the shaft, B, is a pinion, D, which drives the wheel, E, on the shaft, F; this shaft is arranged parallel to the main shaft, and is carried in pedestal bearings on the beams, A. On the inner end of the shaft, F, is a pinion, G, which



gives motion to the wheel, H, and through it to the casing, C, the wheel being fast to the tubular boss of the casing. The grain is fed from a hopper above into the spout or tubular duct, I, on the lower part of which is arranged the sliding spout or pipe, J. This moveable part, J, is connected by links to the forked ends of the hand lever, K, which is fitted with a pinching screw to admit of its being fixed within any part of the traverse of the segmental slot in the guide, L, which is fast to one of the pillars, M. Between these pillars is arranged the receiver, N, the lower part of which forms a hopper communicating with the casing, C, of the mill. The capacity of the receiver, N, being increased or diminished by the raising or depressing the moveable spout, J, through the lever, K, so as to adapt the quantity of grain to be operated upon to the working power of the mill. The hopper of the receiver, N, opens into a shoot, O, which carries the grain through the cylindrical eye, P, of the rotatory casing, C, where it is subjected to the grinding action of the stone, which rubs the grain against the casing, C. The passage of the grain through the feed pipe, I, and the throat of the hopper, N, is regulated by self-acting slides, which open and shut alternately, to admit the grain from the feeding hopper, and allow it to pass into the shoot, O. On the horizontal shaft, Q, is arranged the conical pulley, R, which, by means of the endless belt, gives motion to the lower pulley, S, on the shaft, T. This shaft has on it a worm which drives the worm wheel, U, on the lower end of the vertical shaft, V, supported in any convenient manner. At the upper end of the shaft, V, is a disc, W, the margin of which has a series of holes formed in it; in two of these holes are fitted two studs, X and Y. These studs alternately come into contact with the lateral projections on the sliding bar, Z, which is conected to the slide, *a*, fitted in the duct, I. As delineated in the accompanying figure, the stud, X, which is longer than the other in order to reach the projecting catch on the bar, Z, has moved the bar outwards, and opened the slide, *a*. As the disc, W, moves round, the shorter stud, Y, comes in contact with the longer projecting catch on the bar, Z, and causes it to move inwards and shut the slide, *a*. This action is alternate with the slide, *b*, which is arranged in the hopper of the receiver, N, and is actuated from the disc, *c*, in the same manner as the disc, W, the studs being so placed as to move the slides in and out alternately. Thus, when the lower slide, *b*, is open, the upper one is shut, so that nothing beyond the measured quantity of grain can be admitted to the mill, and the supply is always uniform. The grain is discharged from the casing, C, at regular intervals, by means of a self-acting arrangement connected with the lower disc, *d*, on the shaft, V. This disc has an adjustable roller, *e*, fitted in a slot formed in it, and as the disc rotates the roller comes in contact with the tail of the sliding rod, *f*, which is carried in a guide fixed to the contiguous beam, A. As the roller moves round with the disc, it presses the sliding rod inwards, so that its extremity, which forms an inclined plane, comes in contact with the projecting part, *g*, of a sliding cover, *h*, fitted to the periphery of the casing, C, and which has slits or openings made in it, so that when pushed back these openings coincide with those in the casing. After the roller, *e*, passes the tail of the sliding rod, *f*, the rod is returned to its normal position by the helical spring fitted upon it. The prolongation at the outer end of the rod, *f*, in conjunction with the roller, *e*, causes the inner end of the rod to press back the slide, *h*, and so open the apertures made in the casing, C, and allow the grain to fall through these openings into the hopper beneath, which forms a continuation of the casing, *i*, that encloses the mill. Another mode of arranging the movement of the slide, *h*, is by means of an adjustable cam or wedge piece, fitted in a slot in the disc, and as the disc, *d*, revolves, the cam comes in contact with a jointed rod which is fixed on the beam, A. As the cam moves round with the disc, it presses up the end of the jointed lever, which has a corresponding effect on the inner end of the lever next the case, and causes it to come into contact with the projecting part, *g*, of the slide cover, *h*, fitted to the periphery of the casing, C. After the jointed lever passes over the cam, *e*, it returns to its normal position by its own weight, being made heavier at the end next the disc. The effect of the contact of the inner end of the lever with the projecting part of the slide, *g*, is to press back the slide cover, and so open the apertures made in the casing, C, which are covered by the solid parts of the slide, *h*. In this way, the slide, *h*, is pushed open three or four times before the end of the jointed lever passes over the inclined plane on the disc, *d*; and this is necessary in order to let out all the manufactured grain, which one revolution of the casing, C, is not sufficient to accomplish. The apertures in the casing, C, are closed by a projection on the opposite end of the slide, *h*, coming in contact with an inclined plane, or other equivalent therefore, fitted to the beam, A, on the opposite side of the casing. The time which the grain is allowed to undergo the process of manufacture in the mill varies from ten to thirty minutes, according to the quality, and this is regulated by the position of the belt on the conical pulleys. The grain, as it falls through the openings in the casing, C, is conveyed by the hopper, *i*, to the sifter, *j*, which are suspended by links, jointed to brackets pendent from the beams, A. The lower part of the sifter is connected by a rod, *k*, to the crank shaft, *l*, the pedestal bearings of which are arranged on beams forming a part of the lower framing. The crank shaft, *l*, is driven from a pulley on the main shaft, B, which, by means of the endless belt, *m*, gives motion to the pulley, *n*, on the shaft, *l*. The reciprocatory motion thus imparted to the sifter separates the dust and other impurities from the grain, and the cleansed grain falls into a suitable receptacle, whilst the dust and impurities are conveyed into a separate receiver. In this way, the operation of treating or grinding barley or rice is accomplished in a very rapid and satisfactory manner.

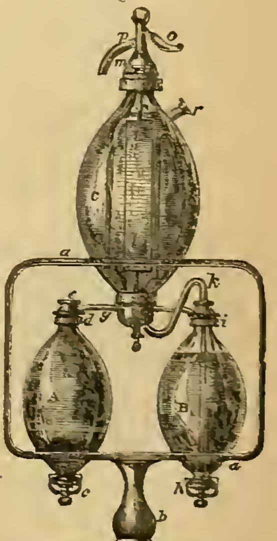
VESSELS FOR THE MANUFACTURE OF AERATED WATERS.

J. H. Johnson, *London and Glasgow*—(Jean Louis Andre' & Philippe Ferdinand Guillot, *both of Paris.*)—*Patent dated May* 14, 1861.

This invention consists of improvements in the portable apparatus used for making aerated liquids, and is partly applicable to ordinary closed vessels or receptacles for containing the same.

According to one modification of this invention the aerating apparatus or "gasogene" is composed of three separate vessels of glass, porcelain, or other suitable material, mounted upon and supported by a stand or frame suitable for the table. In the first vessel the gas is produced in the usual manner, but passes thence by a pipe leading to the bottom of the second vessel, which is filled or nearly filled with water. In this vessel the gas is washed and freed from any impurities which may be carried over at the time of its formation in the first vessel. The gas, having been washed by admixture with the water in the second or washing vessel, passes off by a pipe into the third or distributing vessel which contains the liquid to be aerated, which liquid is discharged or drawn off therefrom as required by any convenient arrangement of valve or cock fitted to the upper part of the vessel. This last-mentioned vessel is provided with an agitator, rotated by a small winch handle, for the purpose of effecting a more perfect and intimate admixture of the carbonic acid gas with the fluid contents of the vessel, which thus becomes thoroughly saturated. The first vessel or generator is provided with a small funnel mouth and cock or valve at its upper end to facilitate the introduction of the ordinary or other powders required for generating the gas, and it is also provided, as well as the second or washing vessel, with a stopper at the lower end, held in position by a screw pressing thereon. In order to obviate the danger of excessive pressure in the third, or containing and distributing vessel, it is proposed to apply a small safety valve thereto, so adjusted as to allow it to open and liberate the gas when its pressure becomes so great as to endanger the safety of the vessel. This adaptation enables the protective wire or canework usually surrounding the vessel to be dispensed with if thought proper. The safety valve may be applied also to champagne, soda water, lemonade and other bottles; also to cafetieres, and other closed vessels of a similar nature liable to internal pressure.

Fig. 1.



The subjoined engraving, fig. 1, is an elevation of one arrangement or modification of this invention; and fig. 2 is a section of the neck part of the lower vessel, A. In fig. 1, A, B, and C, represent respectively the generating, washing, and containing or distributing vessels mounted in a convenient light metallic frame, *a*, provided with a stand or base, *b*. The generating vessel, A, is closed at the bottom by the stopper and screw, *c*, and is provided at its upper end with an internally screwed collar, *d*, into which is screwed the funnel or filler, *e*, for facilitating the introduction of the gas-generating powders into the vessel, a stop-cock, *f*, serving to close the bottom of the funnel after the powders have been introduced. This is shown more clearly in fig 2, which is a section of this part. The gas which is generated immediately the powders enter the water which has been previously poured into the vessel, A, passes off by the pipe, *g*, to the second or washing vessel, B, which is also filled or partially filled with water, and is closed at the bottom in a similar manner to the vessel, A, by a screw and stopper, *h*, a suitable screwed collar or mouth-piece, *i*, being also screwed and fitted at the upper end of the vessel, for the purpose of enabling the bent pipe, *k*, to be readily connected therewith. Through this pipe, *k*, the gas, having been washed in the washing vessel, and thereby freed from any impurities which it may contain, passes up into the third or containing vessel, C. This last named vessel is of a larger capacity than the other two, and is provided internally with an agitator, l, which is actuated as required by a small winch handle at m. The cap or mounted cock, p, at the top may be modified in various ways; for example, a lever, o, may be employed for opening the valve or cock, or a button used for that purpose; r, is a safety valve in connection with the vessel, c, which is so adjusted or regulated as to open and allow the gas to escape on its attaining a certain fixed maximum of pressure. The valve, represented in fig. 1, consists of a mitre valve and spindle, the latter serving as a guide, and being surrounded by a helical spring, which presses upon the top of the valve. By substituting wine or other liquid for the water in the vessel, c, imitation champagne, lemonade, or other aerated drinks may be manufactured in this apparatus. The safety valve may be applied to this and other vessels or bottles containing liquids charged with fixed air either by fitting it to the stopper or by screwing it to a boss or neck formed for the purpose on the body of such vessel or bottle itself, as preferred.

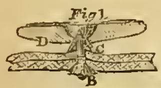
Fig. 2.

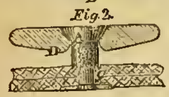
BUTTONS FOR GARMENTS.

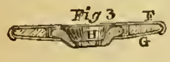
J. H. Johnson—(George Meacham, *New York.*)—*Patent dated May 7, 1861.*

This invention consists of improvements in various kinds of buttons for fastening garments, and other similar purposes.

Figs. 1 to 3, inclusive, of the accompanying engravings, represent in vertical section three several styles of pant or suspender buttons made according to this invention. In fig. 1, A, is a headed shank, having a screw at its lower end, and attached to the cloth by a nut, B, and collar, C, as represented; D, is the button proper, having a hole in the centre made to fit the head and neck of the shank, A, so as to be free to rotate, and to tip to a slight extent thereon. In fig. 2, the shank, A, is made hollow with a female screw, and a male screw, E, is passed up from beneath to secure it to the cloth. The bottom surface of this shank is formed with teeth, by which the action of the button in rotating is prevented from unscrewing the fastening.

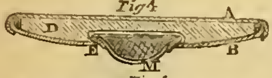


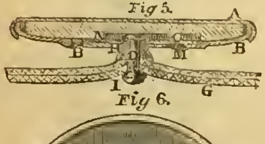


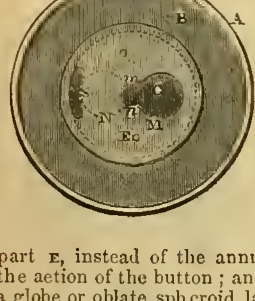


In fig. 3, the button is composed of a front, F, and back plate, G, formed and united in the usual manner, but with a hole in the centre of both, as shewn. In this hole, and enclosed between the plates, F and G, a solid centre piece or shank, H, is placed so as to be free to rotate relatively to the plates, F, and G, but inseparable therefrom. Four holes are made in this centre piece similar to those in ordinary pant or suspender buttons, by which to sew it to the garment, and when thus attached, the rim, F, G, rotates upon H, without causing any twisting strain upon the threads by which it is fastened.

Fig. 4 is a vertical section of a "face" or "covered button," with a cloth or flexible eye, made according to this invention. A, is the face plate; B, the back; and D, the packing of the button: all these parts being constructed in the usual manner, except that D is hollowed at the back, as represented. The back, B, has a hole in the centre for the eye; and a hollow ring of metal, E, with a flange fitted to project through the hole in B, as represented. The flexible eye, M, is laid within this ring, E, and the edges of the same folded over so as to confine it firmly therein. The ring, E, with its eye is placed within the back plate, B, before the button is closed up, and the packing, D, recessed, so as to give it room to turn easily after the button is finished. When M is sewed to the garment, any tendency to turn the button causes the main body to slip around on the ring, E, and all twisting strain upon M and its fastening is prevented. The flange protects M from abrasion against the edge of B, and holds E in position. Several forms might be given to the part E, instead of the annular one, as represented, without impairing the action of the button; and in certain styles, M might be placed upon a globe or oblate spheroid larger than the hole in B, with nearly the same effect.







Other modifications of this form of button are also described, in which a perforated metal eye is employed in lieu of the cloth eye, M, shewn in fig. 4, the face plate, A, being the same as in that figure and in the ordinary buttons of this kind; the back plate, B, is similar to that used in ordinary clothed-eyed buttons, except that a flange is raised around the edge of the hole for the eye. The eye is struck out of sheet metal into a semi-spherical form, or approaching that form, with perforations through which to pass the needle in sewing the button to the garment; and the upper edge of the hollow caper eye is turned over to embrace the flange round the eye of the centre hole in the back, and hold it in place, but so as to allow of the button proper and the eye piece being readily rotated relatively to each other, and the packing being hollowed out sufficiently to allow of such motion. In striking up or forming the metal eye, the portions between the perforations may be rounded in a covered form so as the better to fit the thread, and prevent the corners from cutting it. There is a less liability of cutting the thread in this way of forming the eye than if it were fast to the button, as no twisting strain can be exerted upon the fastening, owing to the fact that the button turns freely upon the eye or centre piece.

In the specification are several other modifications of this class of button, showing ways of connecting the parts to avoid the necessity of recessing the packing, D. The peculiarity of each being that the recess in the back plate, B, for the eye working in, is bent down below the plane of the packing. The way in which the edge of the hole in B is turned in these figures, tends to prevent the edge of B from abrading the thread used for fastening the eye to the garment when the button is rotated.

Figs. 5 and 6 represent a section and plan, looking on the under side, of another style of face button, in which the stud or fastening may be firmly rivetted or screwed to the garment independently of the button proper, the latter being subsequently attached thereto in such a manner as to allow of its turning freely on the fastening, and also allow of different buttons being attached to the same fastening, if desired. The main peculiarity in the construction of this button is in the employment of a moveable key or locking piece within the button, in connection with and arranged relatively to an opening in the back of the button, so that the head of the stud or shank may be placed in the said opening after the stud has been fixed to the garment, and may be securely fastened therein, by which arrangement, whilst the button is at liberty to rotate upon the stud, and to be rocked to a limited extent thereon, it cannot be removed without unlocking or destroying it. D is a headed shank, and H is a collar fitted thereto; I, is a nut or washer. The cloth, G, is placed between the washer or nut, I, and the collar, H, and by screwing or rivetting the shank, D, to the washer, I, the whole is firmly attached to the garment, as represented. A is the face of the button proper, and B the back firmly attached one to the other, and leaving a space in the interior as represented. The back, B, is pierced with an opening, M, m, of such form that the head of the stud, D, may be inserted in the larger part, M, and then be moved to the smaller part, m, at the centre of the back of the button. Within the space between the back, B, and face, A, is placed a disc, C, which is free to rotate relatively to the button, and is pierced with an opening N, n, corresponding to M, m. A slot, S, in the back, B, allows the inserting of any suitable instrument for the purpose of turning the disc, C, relatively to B. To attach this button to a garment, the shank, D, is first firmly fixed to the cloth of the garment, G. The head d, of the shank, D, is larger than the smaller portions, m, n, of the openings in B and C, and smaller than the larger portions, M, N, of the same. When, therefore, the openings, M, and N, coincide, the head of D is inserted through both and then slid into the part, m, n, of the said openings, which correspond with the centre of the button. Now, by inserting an instrument in the slot, S, the disc or piece, C, is turned into the position shewn in dotted lines in fig. 6, completely locking the shank, D, to the button so that it cannot be removed therefrom, though it is free to rotate therein. To prevent any possibility of the piece, C, becoming turned back to its original position, so as to release the stud, D, one or more indentations, E, are made with a sharp-pointed instrument in the back, B, and centre piece, C, which locks the parts C and B together, so that C is no longer capaple of being turned relatively to B; this prevents D from being subsequently removed without first destroying the button. By constructing the stud, D, so as to be fixed to the garment separately from the button, it may be screwed or rivetted firmly thereto without injuring the face of the button. The garment may be finished and pressed before putting on the buttons, which are therefore out of the way while pressing, and when for any reason it is desired to change the button, the face or head, A, B, C, may be broken and removed, and any desired style of button attached to the stud, D, without removing the latter from the cloth, or interfering in any manner with its attachments thereto. Ordinary buttons cannot be replaced after a coat is finished, without either sewing through the lining, and in some instances, lining and pockets, or ripping open and resewing a large portion of the garment.

The remaining figs., 7, 8, and 9, represent several styles of face buttons, in which the back is firmly rivetted to the garment so as to be free to turn and rock upon its fastening, and the face of any desired form subsequently added. In all these figures the back and fastening are similar, the difference being in the style of the face and its mode of attachment to the back.

Fig. 7.

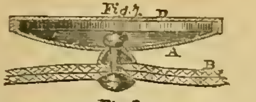


Fig. 8

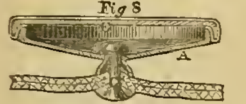


Fig. 9.

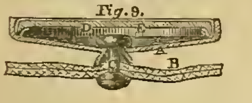


Fig. 7 represents a military button. The back, A, is made with a hole in the centre, by which it is secured to the cloth, B, by a rivet or screw, C, and is free to rotate or assume various angular positions thereon similarly to the buttons previously described. The edge of the back is turned up into a flange with a thread cut on the exterior, as represented. The face is struck out of metal, and has a thread on the interior to correspond with the thread on A. After the back is properly rivetted to the garment, the face, D, is screwed thereon, and as the back is free to rotate with D, in the process of buttoning or unbuttoning, there is no tendency of the parts to become separated by use; should it, however, become advisable or desirable to change the style of the button, or to renew a damaged face, it can be removed by holding the back firmly, and unscrewing the face therefrom, after which another may be substituted. In this way, both oval raised face and plane flat-faced buttons may be adapted to the base, and changed as required.

Fig. 8 shows a similar button covered with cloth, which is put around the face plate, and a piece of cardboard, E, placed thereon to hold it in position. The whole is then screwed on the back, A, as shown, and forms a covered button of an approved shape, having all the advantages of the button previously described.

Fig. 9 shows another style of a covered button, the covered face of which is pressed within the projecting flanges of the back after the latter is rivetted or otherwise fastened to the garment, the edge of the back forming an ornamental band around the circumference.

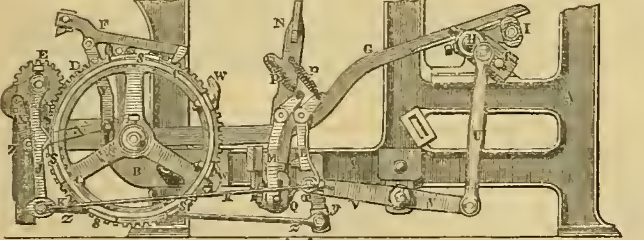
Other styles may suggest themselves in practice; different faces may be furnished with the same back, and can be changed with little trouble at the wish of the wearer.

LOOMS FOR WEAVING.

M. A. Muir and James M'Ilwham, *Anderston Foundry, Glasgow.*—*Patent dated January* 11, 1861.

The improvements which are specified under these letters patent have reference to the arrangement of power looms, as adapted for weaving checked, striped, twilled, or plain fabrics.

Fig. 1.



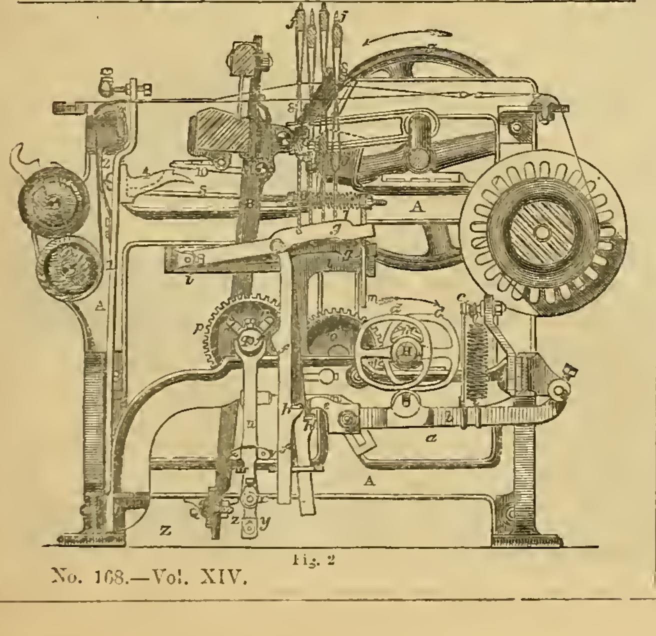


Fig. 2

Fig. 3.

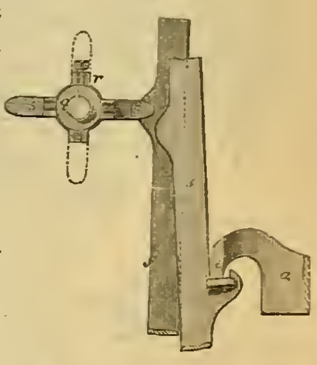
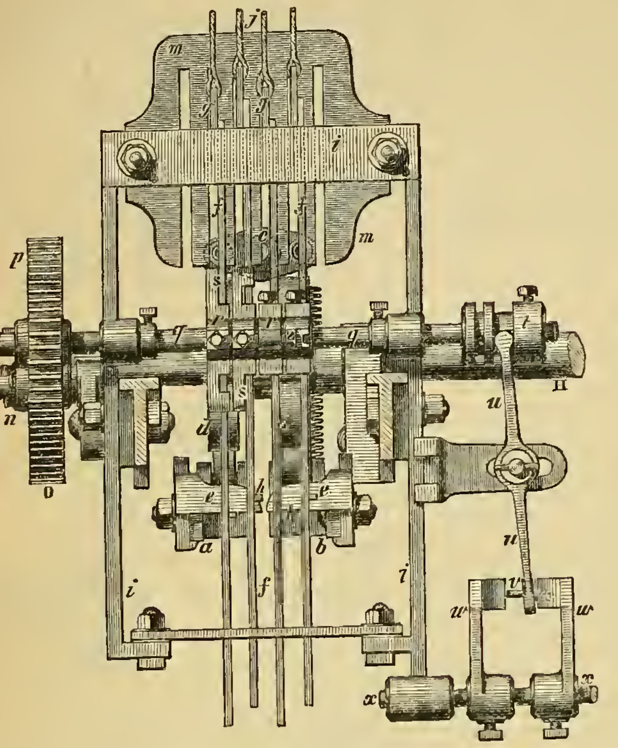


Fig. 1 of the accompanying engravings is an elevation of the lower part of a loom, showing more particularly the portion of these improvements applied thereto for actuating the shuttle boxes. Fig. 2 is a transverse vertical section of the same loom taken in front of the twilling motion, and showing more particularly the improvements in actuating the heddles in the desired sequential order for twilling or for producing other effects in the woven fabric. Figs. 3 and 4 are a partially sectional elevation and front views of a portion of the details of the heddle or twilling motion to a larger scale than seen in Fig. 2. The first part of the present invention has reference to a self-acting mechanical arrangement for actuating the shuttle boxes in the required order. The end standards, A, of the loom are of the ordinary kind, and to the right or left hand standard is fitted the perforated barrel or cylinder, by means of which the shuttle boxes are raised and lowered to obtain the required effect in the woven fabric. This cylinder and a portion of its connected mechanism forms a part of the improvements in looms for weaving, for which letters patent were granted to the present patentees, bearing date the seventeenth day of November, one thousand eight hundred and fifty-eight, and numbered 2581. An outwardly curved bracket, B, carries a laterally projecting stud, on which is fitted the rotating cylinder, C. This cylinder is made of cast iron, its inner margin is toothed and forms a spur wheel, D. The periphery of the cylinder is pierced with two rows of equidistant holes extending round the circumference of the cylinder; or these rows of holes may be arranged in a spiral form. In the upper extremity of the bracket, B, is fitted a stud, on which is carried the pinion, E, in gear with the wheel, D. Motion is communicated either to the wheel, D, or pinion, E, by means of the double-lever catch or detent, F, which is carried loosely upon a stud fixed in the upper extremity of the long bell-crank lever, G. This lever is centred upon the stud which carries the cylinder, C, and its longer arm is curved upwards and extends in a backward direction over the tappet shaft, H, from whence it derives its motion. As the shaft, H, rotates, the cam, I, which is fixed thereto, raises the bell-crank lever, G, which descends by its own gravity when the cam has passed it, so that while the shaft, H, is in motion a continuous reciprocatory movement is imparted to the lever, G. The lifting of the backward end of the lever, G, has the effect of causing the front extremity to move forward, which having connected to it the catch or detent, F, its after end resting on the wheel, D, draws the wheel round one tooth; and so long as the shaft, H, rotates, and the position of the detent is unaltered, the wheel, D, will be moved forward one tooth at a time to each revolution of the shaft, or to each double pick, if required. Provision is also made for moving the cylinder, C, in the opposite direction, which will be referred to after describing the connection of the cylinder with the shuttle boxes. On the stud of the pinion, E, is fitted a pendent lever, J, which is made with an angular projecting part or nib, the apex of which is nearly in contact with the periphery of the cylinder, C. The lower end of the lever, J, is connected by means of the rod, K, with a bell-crank catch, L. There are two of these catches, L and M, one for lifting the shuttle boxes, and the other for retaining them in the elevated position. The catches are centred on laterally projecting studs fixed in the vertical rod, N, carrying the shuttle boxes, O, and in their normal position they are kept in a backward direction by means of the helical springs, P. The lower end of the rod, N, is slotted, and it is carried on a steel stud forming a continuation of the rocking shaft, Q, on which the swords, R, of the lathe are centred. The front catch, M, is made somewhat longer than the other, and it has a projecting part formed on the lower end which rests on the stud in the rocking shaft, Q, when the lower shuttle box is raised to the level of the shed. So long as the projection on the pendent lever, J, moves simply over the periphery of the cylinder, C, no alteration would take place in the position of the several parts; but if one or more pins, S, be inserted in one of the rows of holes in the cylinder, C, the projection on the lever, J, passes over the pins, which has the effect of drawing the catch, L, forward, and this motion pushes the catch, M, off the stud, and the shuttle boxes descend. The upper shuttle box is now level with the shed, and will remain so as long as the lever, J, is kept forward by the interposition of the pins, S: but when the lever, J, moves inward from the absence of the pins, S, the spring, P, attached to the catch, L, draws it back to its normal position in readiness to be lifted. The lifting of the shuttle boxes is effected from the tappet shaft, H, on the outer extremity of which is an adjustable crank, T, connected by the rod, U, with the rocking lever, V, centred on a laterally projecting stud at the lower part of the end standard. The free end of this lever is formed with a small lateral projection or stud on its outer face, which comes under the lower projecting part of the catch, L, when the shuttle boxes are to be raised. The upward motion of the lever, V, lifts the catch, L, which being attached to the rod, N, it is also raised, as well as the catch, M, the helical spring of which causes the projecting part at the foot of the catch to spring over the steel stud in the shaft, Q. The upper part of the stud is squared off to admit of the retaining catch, M, resting fairly upon it, and so long as the position of the lever, J, remains unchanged, the weaving of the fabric will continue to be effected by the weft from the lower shuttle. In this way it will be seen that the arrangement of the movement in conjunction with the disposal of the pins, S, in the pattern barrel, C, provides for the instantaneous shifting of the shuttle boxes up or down, and at the same time regulates the number of shots of weft to be thrown in, either in succession or intermittently, according to the requirements of the pattern to be woven. Thus, where the pattern to be woven is formed of repeats, the pins, S, are arranged in the proper order in one of the series of holes extending round the cylinder, the sequential movement of the shuttle boxes being carried on continuously, and the cylinder always moving in the one direction; but where the pattern requires that a portion of the weaving operation is to be done in the inverse order, the barrel is caused to perform a portion of a revolution, and is then turned in the opposite direction. This is done by means of the stops, W, upon one of these coming in contact with a lateral projection on the bell-crank lever, X, which is a centred on a stud in the bracket, B; the long arm of the lever is depressed, which draws down the link, Y, attached to the fore end of the detent, F, and causes it to engage in the teeth of the pinion, E. The reciprocatory movement of the lever, O, through the detent, F, now moves the pinion, E, tooth by tooth, and the wheel, D, is moved in a corresponding ratio, but in the reverse or backward direction. The extremity of the shorter arm of the bell-crank lever, X, is furnished with a stud, which passes through a slot formed in the bracket, B; to this stud is secured one end of a helical spring, Z, and the other extremity is fastened to the base of the bracket, B. This arrangement holds the lever, X, and its connected parts steadily in position until another change is required, which takes place when the other stop, W, comes round and restores it to the position delineated.

Fig. 4.



Another part of the present invention consists of certain mechanical arrangements for actuating the heddles for producing plain or twilled fabrics. One arrangement for this purpose is delineated in the figs. 1 to 4, but more particularly in the enlarged views, figs. 3 and 4. The treadles, *a* and *b*, are centred on a stud carried in a bracket at the back of the loom, these levers are kept up in contact with the actuating cams by means of the compensating lever, *c*, which is centred on a stud carried in an upwardly projecting bracket bolted to the inner face of the back rail of the framing. The lever, *c*, is connected to the treadle, *a*, by a rod, and to the other treadle, *b*, by a helical spring, and on the tappet shaft, H, are the two cams, *d*, which alternately depress the treadles. To the front extremity of each treadle is bolted a hook-shaped piece of metal, *e*, these hooked extremities extend laterally towards each other, and act as "branders" on the pendent levers, *f*, which are suspended from the horizontal levers, *g*. The upper ends of the levers, *f*, are bent, as shown in fig. 2, so that when suspended freely they have a tendency towards the front of the loom, a swell or projection is formed on the front of each lever, and at the back part is a projecting catch, *h*, which is caught by the hooked extremity or "brander" of one or the other of the treadles when the levers, *f*, are pushed back for that purpose. A second rectangular frame, *i*, is arranged between the end standards of the loom, at the upper part of which is a horizontal spindle carrying the levers, *g*. The number of the levers, *g*, correspond to that of the heddles in use; in the example given in these figs, four heddles are represented in use, but the supporting spindle of the levers is of sufficient length to admit of six or more being fitted thereto. The levers, *g*, are connected by cords directly to the heddles, *j*, which are suspended by means of cords and straps to the segmental rims formed on the ends of bell crank levers. These levers are carried on studs projecting in front of the upper part of the framing, they are connected in pairs and attached to the helical springs, which retain the heddles in their highest position so long as they are not otherwise acted upon. The backward ends of the heddle levers, *g*, pass through a guide plate, *m*, which is bolted to the frame, *i*, this plate is made with a series of slots in it, through each of which is passed the end of a lever so that they move correctly in vertical planes when the heddles are either raised or depressed. On the tappet shaft, H, is fitted a pinion, *n*, which gives motion through an intermediate wheel, O, to the wheel, *p*, which has double the number of teeth to those contained in the pinion, *n*. The wheel, *p*, is keyed to the end of the horizontal shaft, Q, the bearings of which are carried in brackets projecting from the front part of the framing, *i*. Upon this shaft (in the example given) are fixed by means of pinching screws, four tappets, *r*, which are formed, each with two arms or tappets, which, when placed on the shaft, form quadruple projecting parts, as shown in the enlarged sectional end view, fig 3, and in the corresponding front view, fig. 2. One of the arms of each tappet, *r*, is made narrower at the extremity by cutting away a portion of the metal as shown at *s*, so that if the shaft, *q*, is shifted slightly in a lateral direction these narrower parts will pass between the hanging levers, *f*. In this way, the tappets, *r*, are arranged on the shaft, *q*, in such manner that both ends of the tappets will come in contact with two of the levers, *f*, at each quarter turn of the shaft, *q*, and thus cause one-half of the levers or heddles to be caught by the branders of the treadles, and taken down alternately, and thus produce plain cloth. Provision is, however, made for shifting the shaft laterally by self-acting means, and thus alter the sequential order in which the levers, *f*, are actuated, so as to produce the twilling of the fabric. To the right hand extremity of the shaft, *q*, is fitted a clutch, *t*, which is fastened thereto by a pinching screw. This clutch is actuated by the lever, *u*, that is carried on a stud arranged in the slot of a bracket projecting laterally from the framing, *i*. The lower end of the lever, *u*, is made of a segmental figure, and there are holes in this part for inserting pins, *v*, therein. The end of the lever, *u*, extends downwards between the two vertical lever arms, *w*, secured by pinching screws to the horizontal shaft, *x*. The levers, *w*, are made with inwardly projecting parts at their upper extremities, which are bevelled off to a V-shaped figure at the parts next the pins, *v*, the presence of these pins in the lever, *u*, causing it to be moved over to the right or to the left, as shown in fig. 4. The motion of the lever, *u*, moves the shaft, *q*, slightly in a lateral direction, so as to bring the narrower ends of the tappets, *r*, either in a plane with the levers, *f*, or the spaces between them, so as to cause them to come in contact with the levers, *f*, or to pass between as may be required, at each quarter turn of the shaft, *q*. The shaft, *x*, carries at its outer extremity a crank, *y*, which is connected by means of the rod, *z*, with the pendent lever, J, so that in the absence of a pin, S, in the barrel, C, the crank, *y*, is pushed towards the back of the loom. This motion moves the levers, *w*, and by the interposition of the pin, *v*, the lever, *u*, is moved aside carrying with it the shaft, *q*, with its tappet, *r*, so that the presence or absence of the pins, S, in the barrel, C, regulates the movement of the heddles for producing plain or twilled cloth, according to the predetermined pattern. That is, when the narrow ends of the tappets pass between the levers, *f* (as arranged in this example) the broad ones still come in contact with the levers, *f*, in a sequence so as to produce twilled cloth.

In fig. 2 of the accompanying engravings is also shown improvements for stopping the looms by automatic means, both quickly and effectually, without the injurious concussion which arises from the modes at present in use for stopping the momentum of the parts when the shuttle does not "come home." The brake spring, 1, has fixed to the face of it a blade spring, 2, the upper part of which presses against the inner face of the breast beam, 3. To the back of the brake spring, 1, is bolted the stop, 4, to the side of which is attached one end of the rod, 5; this rod connects the spring, 1, with the powerful brake lever, 6, through which the backward extremity of the rod passes. Jam nuts are fitted to the rod, 5, in front of the lever, 6, and at the end of the rod, between these nuts, is interposed the helical spring, 7, the tension of which is adjusted by means of the nuts. The brake lever, 6, is centred on a stud carried in a bracket bolted to the loom framing, and the tension of the spring, 7, is so regulated that the brake, 8, is kept just clear of the fly-wheel, 9, when the weaving is proceeding in regular order When, however, the weft threads break, or the shuttle fails to reach the shuttle box, the lever, 10, not being lifted clear of the stop, 4, owing to the absence of the shuttle, its extremity comes in contact with the notch at the end of the stop, 4. This action pushes the spring, 1, forward, which brings the brake, 8, forcibly down on to the rim of the fly-wheel, at the same time as the belt is being shifted from the fast to the loose pulley of the loom. Owing, however, to the arrangement of the rod, 5, and the spring, 7, the elasticity of the latter causes the brake, 8, to press with a gradually increasing force upon the periphery of the wheel, 9, so that whilst the loom is still effectually and quickly stopped, the sudden concussion arising from the ordinary mode of stopping the lathe and bringing on the break action is avoided, and the motion is in consequence rendered easier and less liable to injure the working parts.

Fig. 5.

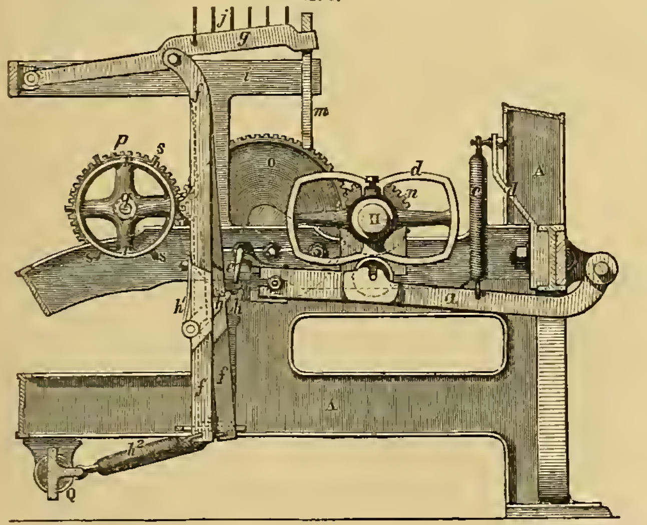


Fig. 6.

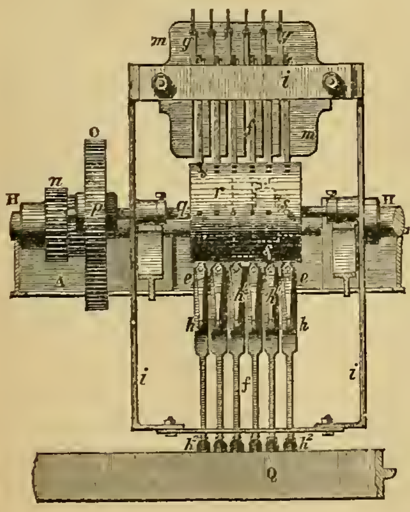


Fig. 5 is a transverse sectional elevation of another modification of the improvements in the twilling action; and fig. 6 is a front elevation of the same. In this modification only one treadle, *a*, is used, which is centred on a stud carried in a bracket at the back of the loom, and is connected to the overhanging bracket, *b*, by the helical spring, *c*. The treadle, *a*, is depressed by the double or two-throw cam, *d*, on the tappet shaft, H, so that it is depressed twice to each revolution of the shaft. To the front of the treadle, *a*, is attached the hook or catch "brander," *e*, which is of a ⊤-shaped figure, and extends across the series of pendent levers, *f*, which are suspended from the horizontal levers, *g*. The levers, *f*, are fitted with the moveable catches, *h*, each of which projects out through a slot formed in the lever and is centred on a pin. A blade spring, h^1, which is secured by a screw to the front of each lever, *f*, presses on the lower part of the catch, *h*, so that if pressed inwards by the upward motion of the treadle, *a*, it instantly returns to its normal position. The lower end of each lever, *f*, is connected by a helical spring, h^2, to a cross rail of the framing, the springs keep the levers clear of the hooked extremity of the treadle, *a*, so long as they are not otherwise acted upon. The levers, *g*, are carried in the framing, *i*, and connected to the heddles, *j*, which are arranged as before described in reference to fig. 2, the corresponding parts being marked with similar letters of reference. On the shaft, H, is a change pinion, *n*, which, through the intermediate wheel, O, gives motion to the wheel, *p*, on the shaft, *q*, on which is fitted the barrel, *r*. This barrel is by preference formed of metal and is perforated, the rows of holes being made so that the pins, *s*, may be arranged to actuate any required number of leaves of heddles. In fig. 6, six rows of pins are shown for actuating a corresponding number of leaves of heddles; the pins may also be arranged in the several equidistant rows of holes to adapt the pins to a like number of heddles, or they may be arranged to suit any other series of leaves, according to the nature of the fabric to be woven. The rotatory movement of the barrel causes the pins, *s*, to come in contact with the projections on the front of the levers, *f*, and as these are pushed back they are caught by the hooked extremity or brander of the treadle, *a*, so as to draw down the corresponding heddles and form the shed. As the cam, *d*, continues its rotatory movement the treadle, *a*, rises, and those levers which were depressed by it are now released and are brought back to their normal position by the helical springs, h^2. In this way the barrel, *r*, may be arranged to produce either plain or twilled cloth, or by a combination of the lateral movement of the barrel, as before described, either kind of cloth may be woven alternately, as desired.

MACHINERY OR APPARATUS FOR TILLING OR CULTIVATING LAND.

Mr William Tasker, *Waterloo Iron Works.—Patent dated May* 21, 1861.

This invention relates to certain arrangements and constructions of windlasses to be employed in tilling or cultivating land by steam power.

According to one arrangement, a suitable frame mounted on two or more wheels is used, having the main axle crossing the frame, such axle serving either to carry the entire mechanism and supporting wheels, or a separate axle for the supporting wheels may be used if preferred.

Fig. 1.

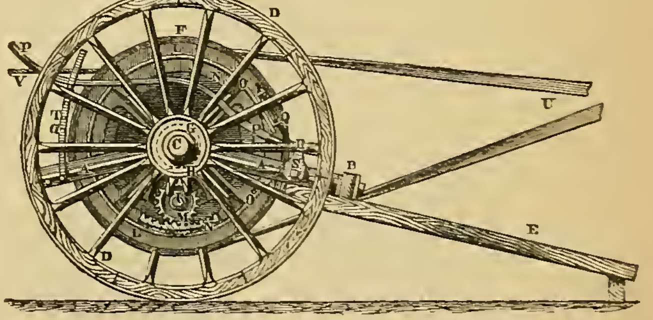
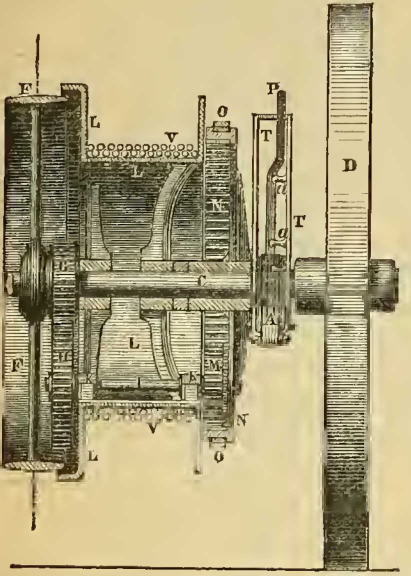


Fig. 1 of the accompanying engravings is a side elevation of one form of this improved windlass. Fig. 2 is a half back end elevation, partially in section, of the windlass at right angles to fig. 1, but to a larger scale, to show the mechanism more clearly. A are two cast-iron beams connected together by the wooden cross bars, B, and forming in combination therewith the main framing of the windlass, which framing is supported upon the axle, C, suitable bushes being made in the beams, A, for the axle to pass through, and for the reception of keys which serve to secure such beams on to the axle. D are two supporting or running wheels fitted loosely on to each end of the axle, C, and serving to facilitate the transport of this portable windlass, which may be drawn to any required locality, (by a horse,) the usual shafts, E, being fitted to the frame for that purpose. On the longitudinal centre of the axle, C, and revolving loosely thereon, is placed the main driving pulley, F, and on each end of the boss of this pulley is secured a spur pinion, G, gearing respectively into the spur wheels, H, fast on the inner ends of the short shafts or spindles, I, revolving in bearings, K, bolted to the interior of each of the winding drums, L. These drums are situated one on each side of the driving pulley, F, and rotate loosely on the axle, C. On the outer ends of the spindles, I, are keyed the spur pinions, M, which gear respectively with the internal toothed wheels, N, also turning loosely upon and supported by the axle, C. The outer periphery or circumference of these wheels, N, is grooved or recessed to receive the wooden friction blocks of the break straps, O, which straps are secured at one end to the cross bar, B, of the framing, whilst their opposite extremes are connected to the ends of the breakers, P, by means of the adjusting screw spindles and nuts, Q, which afford facility for tightening up the straps so as to compensate for the wear of the break blocks. The break levers, P, worked on the fixed studs or spindles R, carried by the brackets, S, bolted to the main framing. The short ends of this lever which passes beyond the fulcrums or spindles, R, are bent or cranked round horizontally, so as to bring them into the same vertical plane with the break straps, O, to which they are attached through the screw buckle, Q, in such a manner that on depressing the free or long arms of the levers, the breaks will be applied to the break wheels, N. T are curved open guiding frames bolted to the rear ends of the beams, A, and provided internally with a number of projecting studs or stops, *a*, which enable the long end of the levers to be held down at any desired position according to the break power to be applied by passing the lever handles under any one of the stops referred to. The upper stops serve also to sustain the weight of the lever handles, and to keep the breaks out of action when they are not required to operate. It will be understood that fig. 2 only shows one half of the machine, and that on both sides of the dotted centre line of the driving pulley, F, it is the same in all respects as that shown in partial section.

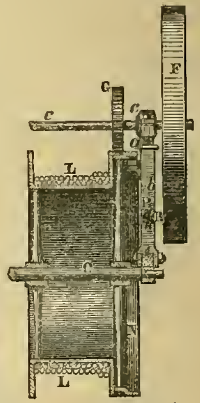
Fig. 2.



The action of this windlass is as follows :—On motion being imparted to the driving pulley, F, by the straps or driving belt, U, which passes round a pulley on the main shaft of the engine, the pinions, G, will transmit a rotatory motion to the spur wheels, H, and to the smaller spur wheels or pinions, M, which latter, by gearing into the internal teeth of the break wheels, N, will have a tendency to impart a rotatory motion to such wheels, causing them, if no obstruction be offered, to revolve freely on the axle, C, as a centre, but without imparting any motion to the winding drums. Now, supposing the break, O, to be applied to the wheel, N, by depressing the lever, P, so as to prevent the wheel, N, from rotating, the pinion, M, will then travel round the stationary internal toothed surface after the manner of the well-known "sun and planet" motion, and carry round along with it the winding drum, L, to the interior of which the bearings of the pinion shaft, I, are bolted, the rotatory motion of the drum continuing so long as the break strap is applied, but on releasing or elevating the break handle the wheel, N, is free to rotate again; and as it offers less resistance to the pinion, M, than the winding drum, L, it follows that the break wheel will be driven, and the drum will remain at rest. The motion of the drum above described serves to haul the plough, or other instrument employed, across the land by winding up the wire rope, V, attached thereto; the return rope coiled on the drum, L, on the other side of the machine, not shown in fig. 2, being simultaneously unwound or drawn off as the implement progresses, such second drum being left free to be rotated by the drawing off of its rope by releasing its corresponding break wheel, N, from the action of the break strap. Thus, in working with these windlasses, each drum is alternately thrown into and out of action by simply applying their respective breaks, or both drums may be stopped or thrown out of action when requisite without necessitating the stoppage of the engine. It is obvious that a sliding clutch-box working on a feather on the axle, and made to engage with a corresponding clutch on the boss of the break wheels might be employed for stopping the rotation of such wheels, in lieu of the break strap; but the patentee prefers to use the break, as it comes into action more gradually, and is free from the sudden shocks attendant upon the use of clutch-boxes. If preferred, ordinary friction cones may be substituted for the clutch-boxes; in which case, many of the objections to such boxes would be overcome. In place of making the wheels, N, with internal teeth, they may be constructed similar to ordinary spur wheels, suitable provision being made for holding them stationary when desired, as hereinafter described; but such an arrangement would not admit of the large diameter of wheel obtained by the internal arrangement, and would consequently involve a certain loss of power.

A modification of this kind is shown in fig. 3, which is a half sectional end view, similar to fig 2, of another arrangement of mechanism for driving the winding drums by ordinary spur gearings. C is the main axle, and L, one of the winding drums loose thereon; *c* is the driving shaft carrying the main driving pulley, F, and spur pinion, G, which is keyed thereon. The pinion, G, in this arrangement gears direct with the spur wheel, N, fast on the side of the drum, L, and is disconnected therefrom by raising the shaft, C. This is effected by depressing the lever, P, which works on a centre, R, and passes through a slot in the pillar or support, *a*, sliding vertically in the guiding column, *b*, bolted to the main framing, A. This pillar covers the bearings of the shaft, *c*, and when elevated causes the pinion, G, to be disconnected from the teeth of the spur wheel, N. Simultaneously with this disengagement of the pinion, the break, O, on the end of the beam, P, is applied to the inner surface of a flange formed on the side of the wheel, N, thus stopping the motion of the drum. The shaft, *c*, should work in spherical bearings, so that one end only may be elevated according to the drum which is to be thrown out of gear. It is obvious that, in lieu of elevating the shaft, *c*, the pinions may also be connected or disconnected with the shaft by an ordinary clutch-box arrangement.

Fig. 3.



LAW REPORTS.

Manufacture of Gas: Hills *v.* Evans.—Infringement—Appeal.—This was before the Lord Chancellor, and was an appeal from an order of Vice-Chancellor Wood, and related to an alleged infringement of letters patent granted to the plaintiff on the 28th of November, 1849, for an invention which (as modified by a subsequent disclaimer) is entitled "an improved method of manufacturing gas." The infringement was alleged to have been committed by the defendant, Frederick John Evans, in the process patented by him on the 27th of August, 1858, for an invention entitled "an improvement applicable to gas purifying." This process has been in use by the London Gas Light Company and other companies, and has given rise to repeated litigation, which has been duly reported in this *Journal*. The plaintiff, Frank Clark Hills, of Deptford, the well-known manufacturing chemist, by the specification in his letters patent claims—first the purifying coal gas from sulphuretted hydrogen, cyanogen, and more or less perfectly from ammonia, by passing it through the precipitated or hydrated oxides of iron, or the subsulphates or oxy-chlorides of iron, from whatever source obtained, and either by themselves or made into a more porous material; and secondly, the repeatedly renovating or reoxidising the purifying materials by the action of the air, whenever they cease to absorb sulphuretted hydrogen, so that they may be used over and over again to purify the gas; with a third claim which is not material. In the month of June, 1856, Mr Hills commenced an action in the Court of Exchequer against the London Gas Light Company for an infringement of his letters patent. This action came on for trial at the sittings after Michaelmas term in the same year, when at the end of the second day of trial the plaintiff was nonsuited. A rule *nisi*, however, was obtained for a new trial, which was ultimately, in November, 1857, made absolute. A new trial was accordingly had at the Guildford Summer Assizes, 1858. This trial lasted five days, and resulted in a verdict for the plaintiff upon all the issues, leave being reserved to the defendants to move on several points of law. The defendants afterwards moved for and obtained a rule *nisi* calling upon the plaintiff to show cause why the verdict should not be set aside and a verdict for the defendants or a nonsuit entered, or why a new trial should not be had. The argument of this rule occupied the attention of the Court of Exchequer seven days, and ultimately, on the 25th of February, 1860, the Court gave judgment, discharging the rule. The effect was to establish Mr Hill's patent against the defendants so far as the Court of Exchequer was concerned, and the plaintiff signed final judgment in the action. The defendants, however, proposed to appeal on the points of law involved to the Court of Exchequer Chamber, under the right of appeal given by the Common Law Procedure Act, 1854, upon which the plaintiff instituted the present suit to restrain the defendants, by injunction, from infringing his letters patent, and for other relief. The London Gas Light Company admitted that they had infringed Mr Hill's letters patent if valid, but contended that for some time past they had used the process patented by the defendant, Frederick John Evans, and which they insisted was essentially different from the invention of the plaintiff. The Vice-Chancellor made an order, declaring that the process in use by the defendants, the London Gas Light Company, and the purification of gas by the material described in the patent of Frederick John Evans, was an infringement of the letters patent of the plaintiff; and, the plaintiff undertaking to abide by any order of the Court as to damages, it awarded an injunction restraining the defendants from the manufacture and purifying of gas according to or in imitation of the patent of the plaintiff, or for other purposes. In the month of March last the case came on by way of appeal before the Lords Justices. On that occasion their Lordships interposed, and the following order was agreed to:—"The plaintiff to serve a notice of motion for a decree forthwith, and the defendants to have six weeks before the injunction commences; and the plaintiff to give an undertaking to be answerable in damages as from the expiration of that period." The case came on for hearing before their Lordships in the month of July last, upon a motion for dissolving the injunction, when an important point was raised whether Mr Hills was entitled to have the injunction granted by the Vice-Chancellor made perpetual at once, considering the amount of litigation that had passed during the last ten years, in which the validity of his patent had been in contest, or whether the condition of the affirmance of the Vice-Chancellor's judgment ought not to depend upon the establishment by Mr Hills of the validity of his patent by a new action at law. Their Lordships took time to consider their judgment, but, as they differed in opinion, a suggestion was made that the case should be reheard before the Lord Chancellor, and it accordingly came on for hearing before his Lordship last term. The arguments had not proceeded far when his Lordship expressed a wish to have the points of law, which were intended to be raised on appeal in the Exchequer Chamber, argued before him.

Reade *v.* Conquest.—Infringement.—This was an action in the Courts of Common Pleas, Lord Chief Justice Erle, and Justices Williams, Willes, and Keating, and it was brought for the infringement of the plaintiff's copyright in the drama of *Gold*, in which a verdict was found for the plaintiff, damages £150, subject to a special case. The case now came on for argument.

The plaintiff in person argued in his own behalf, and Mr Lush, Q.C., appeared for the defendant.

The plaintiff, it appeared, was the author in 1853 of a drama called *Gold*, which had a considerable run, and on which he afterwards, in 1856, founded the novel of *Never too Late to Mend*, which also became very popular. The defendant dramatized the novel, and wrote a drama called *Never too Late to Mend*, which was performed a great many times at the defendant's theatre—the Grecian. This was complained of as an infringement of the plaintiff's copyright, and for this the action was brought. The case found that the drama of *Never too Late to Mend* was an original composition, founded on the novel of that name.

The plaintiff's contention was that he had a stage right in the drama of *Gold*, and that no one had a right to play that drama, or any scene from that drama, without his permission as the author. The novel of *Never too Late to Mend* was a plagiarism from that drama, which he, as the author of both, had a right to make. But although it was admitted that any one had a right to dramatize a novel, and to represent that drama on the stage, yet such a right did not exist to write a new drama on an existing drama, representing the same scenes and characters; and, the drama of *Gold* having been first written and the copyright registered, that was his title to the copyright, and not to the novel, which had been subsequently plagiarized by himself from it.

The learned Counsel for the defendant contended that the defendant had a perfect right to compile a drama either from his own brain or from any existing materials. There was nothing in the Copyright Acts to prohibit that; and he had so compiled the drama of *Never too late to Mend* from the novel of that name. He had also a right to represent the drama he had so compiled upon the stage, just as much as he had a right to read the novel itself upon the stage, which would be no infringement of the Copyright Acts. The defendant was just as much the author of the drama of *Never too Late to Mend* as Mr Reade himself was the author of the drama of *Gold*. The defendant's drama was compiled from the novel, which afforded materials to which he had a right to resort. It was not compiled from the drama of *Gold* at all. It contained five characters and three scenes which the drama of *Gold* did not, and the drama of *Gold* contained nine characters and three scenes which the defendant's drama did not.

The Court took time to consider its judgment.

In delivering judgment the Court were of opinion it was clear that the defendant was guilty of the infringement complained of, unless the facts as stated amounted to a defence; because, if any part of the drama of *Gold* were represented without the author's permission, it was against the provisions of the statute 3 William IV., cap. 15, sec. 2. The fact on which the plaintiff relied was that, the novel being formed on the drama of *Gold*, many parts of it were the same as the drama. The defendant contended that his son had composed his drama of *Never too Late to Mend* from the novel without his ever having seen or known the plaintiff's drama of *Gold*, and that his son was the author of the drama of *Never too Late to Mend*, which he had represented at his theatre, and the plaintiff was not entitled to recover the penalties for which the action was brought, as he (the defendant) had violated no right. It was contended for the defendant that, his son being the author of the drama *Never too Late to Mend*, he had a stage copyright in that drama, as much as the plaintiff had in the drama of *Gold*. But the Court thought that the defendant failed, inasmuch as "parts" of the drama of *Gold* had been copied, although indirectly, and that the plaintiff's right to the sole representation of those parts had been infringed. There must, therefore, be judgment for the plaintiff.—Judgment accordingly.

Annealing Glass and Firing Pottery Ware: Neville *v.* Wright—Infringement.—This was an action in the Court of Queen's Bench, in which the plaintiff sought to recover damages for the infringement of a patent granted to him on the 21st of January, 1857, for "Improvements in Machinery or apparatus employed in the annealing of Glass and the firing of Pottery Ware." The alleged infringement was the use by the defendant of an apparatus for annealing glass in ovens for which a patent was obtained by Mr William Wright, of Newcastle-upon-Tyne, on the 9th of June, 1857, and the main ground of defence was that the use of Mr Wright's apparatus was not an infringement of the plaintiff's invention.

At the trial, which took place at the Newcastle Spring Assizes, in 1861, the plaintiff obtained a verdict, leave however being reserved to the defendant to move to enter a nonsuit or a verdict for the defendant, upon the ground that there was no evidence of infringement, and that the plaintiff's claim as specified was too large. A rule *nisi* was accordingly granted in Easter Term, 1861, upon both points, and also for a new trial, upon the ground that the verdict was against the weight of evidence, and upon the ground of surprise, and on the facts stated in the affidavits upon which the rule was moved. A full report of the trial will be found in our number for August, 1861, p. 128, with wood cuts illustrative of apparatus patented by the several parties.

The rule came on for argument during the past term, before the Lord Chief Justice Cockburn, Mr Justice Crompton, and Mr Justice Blackburn, when Mr S. Temple, Q.C., Mr Monk, Q.C., and Mr Hindmarch, the plaintiff's counsel, showed cause against it, and Mr Manisty, Q.C., and Mr Webster, (instructed by Mr J. Henry Johnson, of 47 Lincoln's Inn Fields,) supported it on behalf of the defendant.

At the close of the arguments, which occupied the greater portion of two days, the Lord Chief Justice Cockburn, in delivering judgment said:—He was of opinion that the rule must be made absolute to set aside the verdict for the plaintiff, and to enter a nonsuit, and also for a new trial. Construing the plaintiff's specification with the disclaimer, the plaintiff, in his opinion, claimed as his invention neither a principle nor a result, but merely a specific means by which he accomplished the result he had in view. That being so, the question was whether or not there had been an infringement, and he thought the result of the discussion had led the Court very satisfactorily to the conclusion that there had been no infringement, because reading the specification with the disclaimer, the patentee specified as his invention,—Machinery comprehending continuity of surface or continuity of motion, if not both, and in the machinery used by the defendant there was neither. That constituted an essential difference between the two inventions. The rule must therefore be made absolute to enter a nonsuit, and as the result of the trial had not been satisfactory, from the defendant being, at the very eve of the trial, as the legal advisers of the plaintiff were perfectly aware, under the belief that what he had to meet was the question of infringement of the apparatus described in Figs. 1 and 2 of the plaintiff's drawings, when the intention clearly was at the trial to contest the matter on the apparatus described in Figs. 3 and 4 of the same drawings; there must, in case the judgment of the Court should be appealed against and reversed in the Exchequer Chamber, then be a new trial.

Mr Justice Crompton and Mr Justice Blackburn, being of the same opinion, the rule was made absolute to set aside the verdict found for the plaintiff, and to enter a nonsuit, and in the event stated, for a new trial.

REVIEWS OF NEW BOOKS.

Adcock's Engineers' Pocket-Book for the Year 1862. 8vo, pp. 352. Wood Engravings. London: Simpkin, Marshall & Co., 1862.

This very useful professional annual brings with it, as novel, in addition to the ordinary almanack and diary matter of the year, a well-selected collection of chapters of reference on subjects always required to be at the elbow of the Engineer. In this respect it keeps us level very fairly with the attainments and the progress of the time. An article on "Rifled Cannon," for instance, taking in the iron shell adopted by the French Government, Wahrendorf's shell, the French naval and Peruvian guns, on Blakeley's principle, the Armstrong, and Cavalli's Italian gun. But nothing is said as to the Whitworth; nor does the article embrace—as it might well have done—anything appertaining to small-bore rifles and ammunition. Books of this class—necessarily compilations—if the matter is judiciously compiled, are of the highest importance to men actively engaged in professional pursuits. Professional men cannot, of course, stop at every step in their work, so varied, with reference to the nature of their materials and the best mode of their employment, to calculate and discuss every detail for themselves. They must always have some reliable authority to which they can turn at once for data as to their procedure; and, hence, we are always glad to see reference works of the kind, issue year by year, continually taking up an enlarged sphere of usefulness. In this respect, we are glad to see that "Adcock" well retains its position.

The Engineers', Architects', and Contractors' Pocket-Book for the Year 1862. 8vo, pp. 434. Plates and Wood Engravings. London: Lockwood & Co, 1862.

This is another well-known annual candidate for public favour, and one which has all along done good service for the practical men in the three professions to which it directly addresses itself. Amongst the leading matter of reference which it contains, the "Memorandum Book of Mr Telford," giving ready details as to "Mechanics," "Air," "Water," "Steam Engines," "Timber," "Iron," "Strength of Various Substances," "Arches of Masonry," and "Miscellaneous Articles," finds a most appropriate place. The various tables of relative measurement, &c., are also well and conveniently arranged; and the chapter on Sewers, with a plate of the "Metropolitan Main Drainage System," is especially well-timed. Another chapter "On Deep Artesian Wells," showing what has recently been done for the attainment of water in this way, including the great and successful boring at Passy near Paris, will also be consulted with interest, as dealing with a subject of the highest importance to Engineers, who, we are persuaded, will shortly have much more to do in this way than hitherto. An "Obituary of Eminent Engineers and Architects for the Years 1860-61," which we are sorry to find so full of great names, completes the volume, which we shall be glad to find occupying the pockets and the desks of the class for whom it is intended.

The Builders' and Contractors' Price-Book for 1862. Revised by George R. Burnell. 8vo, pp. 286. London: Lockwood & Co., 1862.

The voluminous details of the prices of work and materials, and the mode of measurement and charging involved in the practical pursuits of the builder and contractor, are such as to render any honest volume of this class not only most valuable, but absolutely necessary both for employer and employed; and it is satisfactory to find upon the title page of the year's edition of this volume, so sound a guarantee for solid usefulness and accuracy as the name of Mr Burnell as the reviser. What the book has hitherto been is well-known to most of our readers, and a close examination of the details has shown us that the present editor—as, we suppose, we may term him—has done full justice to his task of producing a fair exponent of the value of the various items, treated as they stand, in the present condition of the building trade. The changes in the rate of wages, and the value of materials, and the new applications of machinery, and the new modes of putting work together, appear to have been carefully considered, so as to bring everything fairly up to the actual requirements of the present day. The leading attractions upon the original volume, are, a revisal of the day-work prices throughout; the omission of the prices of terro-metallic goods; the revisal and alteration of the prices of carpenters' and joiners' work, ironmongery and masons' work, and the introduction of new series of prices of gas-fitters' work The text generally has also been very much condensed; and the volume now stands, as it ought to do, in exact accordance with the condition of building and fitting works in the time immediately before us.

We feel obliged to add, however, to our remarks upon these Text Books, that they *all* stand in need of revision; many years have passed since any one of them has been thoroughly rewritten, and were we to enter into details it would not be difficult to show how much of the supposed "cut and dry" information they contain have become antiquated; how much valueless "chopped straw" is to be found when a young man eager for applyable information expects to find wholesome provender; and how many downright blunders an older one may detect; while whole classes of engineering and mechanical knowledge, as to which the "constants" have become numerous, important and certain, are absolutely unnoticed.

The truth is that a thoroughly good and complete Engineers' Pocket Book, is still a desideratum to be supplied in English professional literature. The Germans have, both for engineering and for architecture, much better Text Books of the sort than we have.

As to Telford's Pocket Book—pshaw—curious always, as an indication of the undoubtedly great man; but chiefly showing how imperfect was the education, the want of which he had ever to contend with, that he was no mathematician, and was not even able to spell his mother tongue quite correctly always; as a guide to practice now a days, for any decently educated young engineer, it is perfectly absurd; there is not a youth who has achieved the engineering diploma, of that school at any one of our three great universities that could not show it up; so we should recommend Messrs Lockwood to cut it out of their next edition, and consign it to the tomb of the ponderous quarto of Mr Rickman, whence it was taken.

The Wreck of the Homeward-Bound; or, the Boat of Mercy. By Nicholas Michell. Square 8vo, pp. 30. Plate. London: W. Tegg, 1862.

The Life-Boat, or Journal of the National Life-Boat Institution. 8vo, pp. 16. Plate and Wood Engravings.

"The Wreck of the Homeward-Bound—a poem"—does not fall strictly within our reviewing columns, but we note it here as issuing under the auspices of the National Life Boat Institution, in the furtherance and prosperity of which our readers must be deeply interested, as well on account of the purely philanthropic object of that noble association, as of the spread of those mechanical improvements on which the efficient working of the life-boat system essentially depends. Mr Michell's production is an ardent and well-expressed appeal, which we commend to notice, not merely because its intrinsic merits are of an elevated order, but that should it find its way, as we hope it will, to many libraries and drawing-room tables, the institution will reap some pecuniary assistance from it—the profits from its sale having been placed at the disposal of the institution. It is illustrated by a fine plate of a life-boat proceeding to a wreck.

The "Life-Boat Journal" furnishes, as usual, the current information as to the progress of the institution. The part before us contains engravings of the "Roller-Skids" used by the Norfolk and Suffolk boatmen in hauling up their larger craft, and now adopted by the institution for easing the tractile force necessary for hauling up life-boats.

The Cottage, the Bothy, and the Kitchen, being an Inquiry into the Condition of Agricultural Labourers in Scotland. By James Robb, with a Preface by the Right Hon. Lord Kinnaird. Small 8vo, pp. 82. Edinburgh: William Blackwood & Sons, 1861.

This little volume, so ably written by Mr Robb, and so well prefaced by Lord Kinnaird, goes at once to the root of the objection to the Scottish "bothy" system, under which so great a proportion of Scottish agricultural labourers are housed, if housed it can be called, and points to those remedial measures which the really practised eye can alone discern. Mr Stuart, of Cathlaw, was one of the first to point out the wretched state of the abodes of Scottish agricultural labourers, and the result of his treatment of the subject, was the establishment of the Cottage Association, which supplies, at a cheap rate, plans, specifications, and general information on the subject of farm dwellings. Much good certainly has been done by this institution; but we must regret that farm proprietors have not more largely availed themselves of the advantages thus placed in their way. Still, the proprietors, to effect substantial good, must be encouraged in their work of amelioration by the cottage residents themselves. But the generally untidy habits of the latter stand greatly in the way of progress. The facts embodied in the present volume were obtained by the author's personal visits in five Scottish counties—which proved that, generally speaking, the "cottage" system prevails in East-Lothian; the "bothy" in Fife and Forfar; the "kitchen" in Aberdeen; whilst, in Ross, there is the system of "crofts." Good and bad specimens were, of course, found in all the classes, and we are sorry to hear that some of the dwelling accommodation is dismal indeed. Upon the whole, Mr Robb comes to the conclusion, that farm servants are not, as has been asserted, in a worse condition than they were fifty years ago; that the abused bothy or miserable hut system is by no means so common a plan of housing ploughmen on large farms as is generally thought; nor are the bothies anything like so disgraceful as they are imagined to be; that, not being immoral, *per se*, the bothy system is one of the best yet devised for unmarried ploughmen, on farms of such extent as to require several unmarried men, more especially if the bothy is of the improved fashion to be seen in Fife, Forfar, and Aberdeen; that of all modes of housing farm servants, the "kitchen" system is the worst on the score of immorality, as the men and women take their food and spend their evenings together in the kitchen, whilst the unmarried men sleep in out houses or stable-lofts; that a mixture of married and single men appears to answer best, the married men having cottages in the vicinity of the steading, and the single men living in bothies; and, finally, that whilst the "croft" system would involve the cutting up of large farms, no substantial benefit would be derivable in return, judging from the condition of the existing small farmers and crofters. The author gives some most interesting details as to the amount of wages and the mode of living in the districts which he visited; and his book is, upon the whole, a very readable one on a subject which really well deserves to be looked at carefully and discriminatingly.

MANUAL OF TIDES AND TIDAL CURRENTS. By the Revs. Joseph Galbraith and Samuel Haughton, Fellows of Trinity College, Dublin. Second Edition. Liverpool: Philip & Son, 1862.

WHAT is a wave? Oh! nonsense, every one knows that; go down to the sea-shore and you may see and feel plenty of them, replies friend commonplace, in blue jacket or in brown. But what is the wave? how does it move? Ah! you don't know. No! Neither does one man in five thousand of Britons, who declare they always will, rule the waves, know anything about them beyond the name, and being able to recognize a wave when they see it. Yet, to have a clear comprehension, and grasp, so assured of his knowledge, that he can apply in the midst of storm, darkness, and danger—of the inner nature and mechanism of motion, of these same waves—is essential to the navigator of our narrow island seas; the preliminary to his own safety and all committed to his trust and guidance: for, otherwise, he either knows nothing of where, or at what rate the tide wave is affecting the course of his ship, or he attempts to grope for knowledge by the help of rules and maxims, of the truth and foundation of which he must remain in utter ignorance. The names of Galbraith and Haughton have become almost proverbial in connection with their series of Educational Manuals; so widely adopted wherever the importance of lucidity, accuracy, and succinctness in elementary books has been recognised, qualities that beyond all others, require absolute grasp and completeness on the part of an author.

Most, if not all, previous manuals of the series have been academic books, designed for those at the usual epoch of pupilage in life. Here is one, however, designed for, and capable of, rapidly and well informing, many an older scholar; and it will doubtless find many amongst our mercantile marine in active duty afloat, as well as be received as a text book ere long for mercantile marine examinations under the Act.

Some of our readers are probably aware that the science of Tidal movements has long engaged the attention of Professor Haughton; that he has discussed more than one series of elaborate Tidal observations round the British coasts, and communicated papers of the highest importance to the Royal Irish Academy on the subject. His mind filled with the subject he naturally applied his own Tidal knowledge to the published facts of several of the terrible wrecks that have of late years happened (chiefly to outward-bound ships) in the Irish sea, and other of our narrow waters around the British islands. The result was toprove to his own mind, with a probability little short of demonstration, that almost the whole of these wrecks, with all their suffering and loss of life and property, arose from ignorance of the nature and effects of the Tidal currents in those seas.

The object of the present manual, then, is to afford to seamen of the coasting navigation (and every ocean-going ship is a coaster on setting out and returning) a brief, clear, and comprehensive exposition of the nature and laws of Tidal action in general; of the action of the ocean tide, as modified, in approaching coasts and narrow waters; of the effects produced by these inshore tides upon a ship's position and course; with simple rules and excellent tables for making use of them.

The subjects of primary importance to the navigation of a ship in the dangerous seas that surround the British coasts are—1st. The state of the compasses, especially in iron ships; 2d. The practical use of the sounding lead in approaching or navigating the channels in foggy or coarse weather; 3d. The laws of the Tides and Tidal currents. To the first great attention has been devoted; and as to the second, it has been held, the condition, that upon the use or not of the lead line in cases of masters having got their ships aground, their certificates should or should not be cancelled. But to the third, the authors state that much less attention has been given than its high importance to the safety of shipping demands. Indeed, until about 1848, when Rear Admiral Beechey, R.N., communicated to the Royal Society his Tidal observations—since become the basis of the "Tide Tables for the English and Irish Ports," published yearly by authority of the Admiralty—so little was known of the subject that the channel sailing instructions of the late Mr John Nimmo, C.E., are pronounced by the authors wholly erroneous and dangerous.

They substantiate their views, as to the unseen but often formidable effects of Tidal currents of indraught and outdraught, in our narrow seas, by appeal to and analysis of several examples, as the loss of the Pomona, in 1859, on Blackwater Bank; of the Emperor and the Lady Ebrington, grounded on the same in 1857, and of the Irrawady in 1856. With the true philosophy of men who understand their subject, they begin at the beginning, and, in the first and second chapters, labour, not with prolix elaboration, but with brevity and clearness, to enable an unscientific man to understand enough of the great cosmical forces productive of the Tides, and to grasp the notion of what is the Tide wave; and, therefore, to understand (and not merely accept, as he is told), how it is that, while the crest of the tide wave, or, what is the same thing, the time of high or of low water, moves at a rate of from 20 to 50 miles an hour (in the Irish sea for example) the Tidal stream, that which produces the indraught or outdraught that affects a ship, only moves at most about 5 miles per hour. To *understand* this a seaman must understand *what a wave*, small or large, *really is*.

Very few do so; indeed, we make bold to say that there is no one subject of physics or mechanics, or both, upon which so much ignorance prevails even in circles supposed well-informed, on all that refers to waves, whether liquid waves as here in question, or sonorous waves in air or like media, or these again or others of greater amplitude, that constitute impulses in solid media, such as earthquake shocks. The knowledge of all alike depends, at bottom, upon a clear conception of what a wave is, and then of its two independent motions; the one those of the *particles oscillating* in the wave itself; the other *the translation of the form* of the whole group of oscillating particles from place to place.

We could point to passages in the writings of geologists of our own day, and of undoubted eminence, which show that this fundamental conception has never been received by them; and that, hence, their discussions as to Tidal action, to adduce nothing further, in modifying sea-bottom and land, are often insufficient or erroneous.

Nothing can be happier or simpler than the methods and words in which all this is here explained.

We have space but to quote a single paragraph.

"When we see waves from the sea rolling towards a beach, we speak of the motion of the wave taking place in a single direction, viz., towards the shore. If now we look at the motion of small floating objects, such as pieces of sea weed, &c., we shall observe that they move forward on the crest of each wave, through a few feet or inches, then stop, move backward again in the hollow of the succeeding wave, stop, and again move forward, as before, on the crest of the next wave. Here we see clearly the difference between the apparent wave motion, which takes place towards the shore, and the actual motion of the water, which is only forward and backwards through a very small space." (p. 15)

The illustration given on the next page, by the progress of a wave of contagious epidemic, say from London to Liverpool (originally due, if we mistake not, to Professor Airy), is very happy; but we regret almost that the authors, probably for sake of brevity, had not added to it, Sir John Herchell's illustration—given in his article Light (*Encyclopedia Metropolitana*) derived from the waving of ears of corn under the transit of the wind, which we deem the best and most exact ever produced.

We regret that our limits will not admit of a longer notice of this little book, which, within the brief compass of about 80 pages, gives a surprising amount of valuable information. Appended are three useful Tidal Tables for working the rules contained in the body of the work. The first of these, we think, might, in future editions, be advantageously curtailed by a proper note for then reading it, inasmuch as the columns of Tidal streams, at equal hours before and after the 3rd, are the same.

There are eight very clear plates, on wood, two of these, in plate 1, printed in red and black; the Tide Chart of the Irish Sea and plate iv. printed in the same way. The cotidal map of the ocean and seas all round the British Islands is by far the clearest and best calculated to make the subject intelligible to the class for whom this book is mainly intended, that we have ever seen.

Space forbids us to notice further here the Tidal clock, to show by construction the drift, and rise, or fall of Tide, of which the authors have published a separate card, and which we have reproduced in the present part.

CORRESPONDENCE.

☞ We do not hold ourselves responsible for the views or statements of our Correspondents.

THE RIGHTS OF AUTHORS AND INVENTORS, AND THE OPINION OF BARON BRAMWELL THEREUPON.

SIR,—Baron Bramwell is reported to have publicly averred that the sole right of an author or inventor, is to keep his thoughts or discoveries to himself,—from which it follows, that, in the Baron's opinion, any *property* in such thoughts or discoveries, or power over them, after they are made known to the world, is purely a matter of *grace and favour*, conferred by the legislature on (just or mistaken) considerations of public policy.

This is surely a complete misapprehension of the nature of the case. The rights of an author, (taking his case first), are based upon a contract; that is to say, upon the implied terms of the contract between him and the purchaser of his book,—which implied terms might readily be expressed, if it were deemed necessary so to do. Thus, upon the title page of every copy of a given book, two prices might be set forth; viz., a large price (as £500) and a small price (as £1). It being clearly expressed that a buyer, who desired to republish the work, might obtain the right so to do by paying the large price, and that on the contrary those buyers who elected to purchase at the small price, would simply acquire the right to use the work for the ordinary purposes of reading, reference, &c, at the same time binding themselves not to republish the work.

As respects further subsequent transfers of the work, it is manifest that a man cannot sell that which was never his; so that whether a buyer at the smaller price re-sell the book, or give it away, or even lose it, so that another person finds it, in neither case can the transfer of the book create, in favour of its new owner, a right which its previous owner had never possessed.

A contract thus clearly defined, and entered into voluntarily by the respective parties must surely be as binding in justice as other contracts, and as much entitled to legislative protection.

It may be objected that these terms are *not* thus expressed. True,—but the law, in respect of other contracts of various kinds, does assume that certain conditions are implied; thus dispensing with an endless repetition which would be unavoidable otherwise. And the law of copyright simply assumes that a man, buying a book over the counter, understands and accepts the implied condition, that neither he nor any one deriving from him, acquires thereby any right to republish the book. In short, the law recognises the plain fact that the sale of a book, for ordinary uses, is one thing; and its sale, for the purpose of reproduction, another, and distinct matter; and refuses to allow unscrupulous people to confound the one with the other for their own purposes. And so far from conferring any special privilege upon an author, the law of copyright does really (by withdrawing its protection after a time) curtail the rights, to which he appears to be just as well entitled, as parties to the many contracts that are wholly free from such limitation.

If an author, *i.e.*, the inventor of a book, can thus sell his work, copy by copy, under a binding contract, the legally implied terms of which debar the buyer from republishing the work,—and of course debar all subsequent holders, who, deriving wholly from the first buyer, cannot possibly derive from him what he never possessed,—Why should not the inventor of a *machine* be enabled to sell his invention under a similar contract, and under the same legal protection? The principle is the same in the one case as in the other; any administrative difficulty concerns, not the principle, but merely the degree of practicability of carrying it out.

Thus the learned Baron,—if he chose to judge of this matter by the narrow rules of the mere lawyer,—had only to apply these rules correctly, in order to have arrived at the more satisfactory conclusion that the labourer, "worthy of his hire," could have it secured to him without straining, in the least, those principles which ordinarily guide the legislature in matters between subject and subject.

E. H.

THE CONNECTION BETWEEN THE SPECIFIC HEAT AND THE COMPACTNESS OF SUBSTANCES.

I am obliged to you for the publication of my communication having the above title, but surprised at the very flimsy opinion you have pronounced concerning it, which, had I foreseen, I should have hesitated before submitting it to you.

I commence my reply by desiring all who are disposed to controvert my views, *carefully* to read and weigh every sentence and parti-sentence of the letter in question, when they will (or most of them) I am convinced, perceive that the conclusion arrived at is a philosophical one. That there is not a connection between the density of any substance and its hardness, appears from the fact that the degrees of the hardness of substances are not more or less according to their density, and *vice versa.* And as to the assertion that all substances are not rendered harder by compression, I deliberately assert that every body, unless by sufficient compression, either as regards time or degree, its state is changed, is thus affected, which *proviso* might of course have been supposed. Even all fluids and liquids are thus made denser, and therefore "harder," which effects, however, are not very palpable ones. My "notions" respecting the vibrations of interfluent ether, are the only conclusions which can philosophically be drawn from what we at present know of ether and matter, and are, I take it, realities. In the letter, at the third line from the bottom of the page, the word "maintained" should be read instead of "aimed at."

February, 1862. J. Alexander Davies.

[Our correspondent, Mr Davies, belongs to the dogmatic set of philosophers. We fear, however, his being convinced, or deliberately asserting his views, will not bring conviction to our readers. Nor can we insert communications unless accompanied by something of demonstration and example.

Up to the present we must confess to having but a very misty notion of what Mr Davies' views *are,* but so far as we have any conception of them, our queries in our last still seem to us pertinent and not yet answered.—Ed.]

MECHANIC'S LIBRARY.

Arches, Principles of Construction in, new edition, 12mo., 1s. 6d. Blaud.
Civil Engineering, Manual of, cr. 8vo., 16s., cloth. Rankine.
Engineers, Lives of the, vols. 1 and 2. 8vo., 42s. cloth. Smiles.
Globes, Introduction to the knowledge of, new edition, 3s. Maynard.
History, Student's Text book of, cr. 8vo., 2s. Beale.
Organ, A few notes on the Temple, 2d edition, 16mo. 3s. 6d., hf. bound. Macrory.
Ruskin, Selections from the writings of, cr. 8vo., 6s., cloth.
Science, Treasury of, edition by Medloch, new edition, 8vo., 7s. 6d. Schoedler.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INSTITUTION OF CIVIL ENGINEERS.

January 14, 1862.

We are enabled to print "in extenso" the subjoined Inaugural Address delivered by Mr Hawkshaw, president of the Institution of Civil Engineers; and we make no apology for presenting our readers fully with undoubtedly the ablest address of the sort that has for many years been heard within the walls of the Institution. It well reflects the characteristics of the President's mind—judgment, solid, certain and mature—knowledge, sufficiently ample and exact, of improvements up to the hour; and beneath an exterior somewhat silent and reserved, a real enthusiasm and love! for his and our own—the highest of all arts—the culmination of all minor ones.

Gentlemen,—I beg to thank you for the honour you have done me, in electing me to the office of President of this Institution.

In undertaking the important duties it involves, I can safely promise not to fail in their discharge from any want of interest in your proceedings, nor from any lack of zeal for the advancement of the objects of the Institution.

The profession of which we are members has from my earliest days been an object of attachment to me, and were I actuated by no other motives, the love I bear to it would prevent me becoming lukewarm to its interests. For my deficiencies, I trust to your forbearance, and rely on the help of the many friends I see around me.

It is important to notice at the outset, that the wide range of subjects which the profession of a Civil Engineer embraces, renders it imperative on every member of it to avail himself of all the help he can obtain. He requires the assistance of many departments of science and art, and must call into employment important branches of manufacture. He can perform no great work without the aid of a great variety of workmen, and it is on their strength and skill, as well as on their scientific direction, that the perfection of his work will depend. The personal experience of one individual cannot fit him for the exigencies of a profession which is ever extending its range of subjects, and is constantly dealing with new and complex phenomena; phenomena which are all the more difficult to deal with from the fact, that they are generally surrounded by such variable circumstances as render them incapable of being submitted to precise measurement and calculation, or of being amenable to the deductions of exact science. Consequently nothing is more certain that he who wishes to reach the the perfection of his art must avail himself of the experience of others, as well as of his own, and that he will not unfrequently find the sum of the whole little enough to guide him.

And let no inventive genius suppose that his own tendencies or capabilities relieve him from this necessity.

There is, I believe, no such thing as discovery and invention, in the sense which is sometimes attached to the words. Men do not suddenly discover new worlds, or invent new machines, or find new metals. Some indeed may be, and are, better fitted than others for such purposes, but the process of discovery is, and always has been, much the same. There is nothing really worth having that man has obtained that has not been the result of a combined and gradual process of investigation. A gifted individual comes across some old footmark, stumbles on a chain of previous research and inquiry. He meets, for instance, with a machine, the result of much previous labour; he modifies it, pulls it to pieces, constructs, and reconstructs it, and by further trial and experiment, he arrives at the long-sought-for result.

While, however, it is necessary, if our progress is to be safe, that we should proceed with due caution, it is exhilarating to notice, that in the matters to which our profession relates, progress is more apparent than it is in most other pursuits.

The great range of objects which it embraces, and which seems ever extending, partly, no doubt, accounts for this.

We are called upon to construct the great highways of nations, and to build the steam-boats that bridge the seas. We make the machines by which man seeks to lighten labour and to accumulate force, or to give to that force new directions. We build docks, harbours, and lighthouses, to receive, shelter, and warn the mariner; and, as if in contrast to works so useful and so humane, some of us are occupied in the warlike objects of defence and destruction. And at this day, young Members can look back far enough to distinguish the rapid progress that has been made in those matters in which the Civil Engineer has to devote his attention.

Thus, it is hardly thirty years since travelling began to be transferred from common roads to railways. In the comparatively short period that has since elapsed, in a less space of time than one generation of man, about seventy thousand miles of railway have been made in different countries, at an outlay of about eleven hundred millions of pounds sterling, and involving an amount of engineering works exceeding in magnitude and importance all the previous engineering works of the world put together.

In effecting this great change, English Engineers have taken a prominent part, about one-half of the vast outlay above referred to having been expended under their direction, and they may, I think, feel a pardonable pride in the great works which they have helped to construct, and which are destined to produce an amount of beneficial change and advancement in the habits and culture of mankind, which the most sanguine man of the present day will probably fail fully to estimate.

Simultaneously with this change and tending to the same ends, there has been the improvement of steam navigation. I crossed the Atlantic in 1835, in what was then considered one of the swiftest packets; but in those days the Atlantic packets depended wholly on sails, and the voyage occupied twenty days. Many years have not elapsed since it was denied that steamers could cross the Atlantic at all. They do so now in nine days. The progress that has been made in steam navigation in the last few years is truly remarkable. The steam-boats plying between Holyhead and Dublin, which were then, as now, among the fastest afloat, had, ten years ago, attained a speed of seventeen miles an hour. Last year these boats were superseded by others; the Leinster, Munster, Connaught, and Ulster, which attained on their trial trip a speed of twenty miles and a half, an hour.

Great progress has also been made in the application of the screw-propeller to steam-ships, which, for vessels of war, and other purposes, possesses advantages over the paddle, though it has not hitherto accomplished an equal speed.

In 1848, the fastest screw line-of-battle ship in the navy could not steam more than about seven and a half knots, or eight miles and two-thirds per hour, whereas, the "Warrior," though clothed with an outer coat of iron armour four inches and a half thick, at her trial in October last over the measured mile in Stokes Bay, attained an average speed of 14·356 knots, or 16·533 miles per hour, beating the "Howe," which previously had attained the highest trial speed of any of Her Majesty's line-of-battle ships; the displacement, power, and speed of the two ships being as follows:—

Name.	Displacement.	Indicated Horse Power.	Speed per hour.	
			Knots.	Miles.
Warrior . .	8,852	5,469	14·356	16·533
Howe . . .	4,770	4,523	13.565	15·623

Since 1848 the speed of this class of ships has been nearly doubled. The build and construction of steam-boats has also, during the same period, received much attention, and been greatly improved.

The doubts which prevailed until very lately, whether iron was the best material for line-of-battle ships, seem now nearly dispelled, although the rapidity with which iron fouls will, unless some remedy can be devised, always be a source of trouble.

The precise and best mode of constructing iron ships of war is still an interesting problem; and many improvements may still be expected in an art which is yet in its infancy.

Hitherto a large amount of wood has been combined with the iron. The "Warrior" has a thick lining of timber between the inner skin and the outer armour-plates. A material so soft as wood can hardly increase the capability to resist shot; and there seems great difficulty in combining, to any good purpose, two materials differing so much in strength and density. Besides which, wood rots, and is, in ships especially, a perishable material. The probability is that iron will supersede the use of wood in a still greater degree, and that, by the adoption of improved modes of construction, the whole of the iron used in the structure of ships of war will be made to add to the strength of the ship, as well as be useful for its defence. This is not the case in the present mode of construction. The armour-plates of the "Warrior" add very little to the strength of that ship. There seems to be no good reason why the upper and lower decks, and every portion of the hull of such vessels should not be of iron. Greater strength would be thereby attained to resist diagonal and cross strains, and much greater longitudinal stiffness would be secured. Ships of war should be constructed practically, as far as it is possible, as if welded out of one piece of iron; and if they are ever to be used as rams, this mode must be adopted, or it is evident that the present methods of construction would be quite unsuited for such a purpose.

That war-steamers and other steam-ships can be made stronger, and may be made to steam faster than they yet have been, there is no doubt. No one can have taken the trouble to examine the present methods of building without seeing that it is easy to increase their strength without impairing their efficiency in other respects.

With regard to the speed we ought to obtain, it is with steamers as with locomotive engines, a question just now of what velocity we can afford to pay for, rather than of what rapidity we can physically attain. There is no doubt that the speed of either could be accelerated beyond any point yet reached, and probably beyond any point that the nation at present could afford.

The speed of steam-boats and of railroads will have to be determined from time to time, and will vary with circumstances, with place and time, with the accumulation and distribution of wealth.

For cost after all greatly, if not rigidly, regulates progress, whether it relate to civil, to military, or to naval affairs. A hundred years ago no nation could have afforded railways of fifty miles an hour, nor steam-boats of twenty miles an hour. The reasons for this are obvious, though often overlooked. Passengers, for instance, can afford a higher rate of speed than goods and minerals: and some descriptions of merchandise require to travel faster than stone, coals, &c. Again, some passengers can better afford to pay for speed than others. Even now it is on certain lines only that there are a sufficient number of passengers who are able to pay for express-trains, and where consequently the appointment of such trains can alone be justified. We have not yet, as it respects steamers (except for short distances), secured an equal amount of passenger traffic; and until this be the case, they must be built and worked for passengers and cargo. Moreover, wherever time is an element of importance, the exigencies of trade and the convenience of the public require frequent opportunities of travelling and of transport from place to place. This circumstance determines the number of passengers and weight of goods to be conveyed each journey from each place, and, combined with other circumstances, establishes a law which for the time being regulates the load on every railway, in every steam-boat, and along each line of communication. Thus, large and powerful as locomotive engines have become, they convey on the London and North-Western and Great Northern Railways an average load of less than 70 tons of merchandise; and though the Lancashire and Yorkshire Railway has a larger mileage of merchandise traffic than either, the average load, owing to the close proximity of towns and the greater necessity for frequent trains, is only about 45 tons. The same principle applies to steam-boat traffic. Again, however superior for naval warfare a steam line-of-battle ship may be to one with sails, yet England, rich as she is, could not at the present day undertake to support a navy which should wholly dispense with the use of sails, which should move to, and from, and among her distant dependencies by the power of steam alone, and which consequently, would always be dependent upon, and therefore would always require to be supplied with a sufficiency of fuel.

With respect to the speed of railways, there is at present an anomaly, which, before long, will require more attention than at present has been bestowed upon it. Thus, to make way for passenger-trains, goods and mineral trains, which might move more slowly, are, in many cases, hurried on, manifestly to the prevention of due economy.

Besides, though I deem it possible that railways ultimately will be made for greater speeds than those at present adopted, I am of opinion that on some lines the Companies have attained a rate of travelling which is in advance of their appointments in other respects,—such as with the condition of their road, and with the state of their finances. Railway Companies already feel that great speed demands larger expenditure upon their permanent way—their rolling stock—for telegraphic signalling—and for other matters, without which the continuance of such speed becomes positively unsafe: and if the whole of the expenditure which great speed thus entails upon Companies were fairly met, it is questionable whether the present speed of railways is not now, in many cases, fully greater than can be afforded.

Goods and minerals, on busy lines, are, there can be no doubt, carried at a speed which is neither demanded by the public nor is economical to the Company; but which is often rendered unavoidable from the necessity of keeping out of the way of swift passenger-trains, and by the difficulty of interpolating goods and mineral trains among the frequent trains of a large passenger traffic.

But is there no remedy for this? The travelling public demand from Railway Companies the highest rate of speed they can exact; and that, as I have observed, is sometimes greater than the state of the road and other matters warrant. Would any good result from the introduction of Government interference to regulate speed? I think not. Such a measure might strike at the root of improvement, and the evil is one which will work its own cure, and for which a remedy may be provided in different ways.

It has been urged that the time of travelling between two points may be shortened as well by diminishing stoppages as by an increase of speed. But this mode of dealing with it again becomes a question of cost; for if local traffic is not to be neglected, diminishing the number of stoppages involves more trains, more expense therefore, and the difficulty of applying this remedy will increase with the growth of traffic.

It may have to be met, in certain cases, by constructing lines to carry goods and minerals only, at a slow speed; and ultimately, perhaps, in other cases, at some future day, by making railways to carry passengers mainly, if not solely.

In grouping engineering works we may class the electric telegraph with railways and steam-boats. All three are agents of intercommunication, and tend to the same important ends. And while the vast importance of each cannot be overrated, the electric telegraph is, perhaps, in the peculiarity of its operation, the most wonderful of all.

It was about the same time that the Liverpool and Manchester Railway was started that the minds of a few individuals were first devoted to the subject of using electricity as a medium of communication for messages.

Messrs Cooke and Wheatstone's patents were taken out in 1837, but the first public telegraph was not established till 1839, when a communication was made by wire on the Great Western Railway between London and Slough.

Since that period, in this country alone, telegraphic communication has been extended over about 14,500 miles; in the rest of Europe, over about 100,000 miles; and in the American States, over about 48,000 miles; and the total extent of telegraph at this moment cannot be less than 200,000 miles.

On land, this most useful discovery has been uniformly successful. Like railways, it has grown (in England, by public support alone) into a great institution.

Ocean telegraphy has been less fortunate in its results. Short lines across the narrow seas have been laid and maintained, but at a serious amount of cost.

To some extent, no doubt, the failure of deep-sea telegraphs may be attributed to ill-conceived arrangements, and to faulty designs and workmanship; but the very nature of such an undertaking as laying telegragh wires across the Atlantic precludes the possibility of acting on previously-acquired experience, and makes the requisite experimental trial one of serious cost.

The labours of the late Commission appointed to inquire into this subject have made the necessary scientific conditions for forming a good ocean cable better, and perhaps sufficiently understood. But they leave the ultimate cost of maintaining a permanent and available communication across three thousand miles of ocean (as, in fact, the great attendant contingencies compelled them to leave it) a question for the future to decide.

A communication with America once well established, would call for numerous wires. To meet contingencies, risk of accidents, and stoppages, a single cable would hardly be sufficient. With ample provision in these respects, a communication between the two countries could be maintained, but at a cost not at present admitting of calculation. There are some things physically practicable, but which in a commercial and monetary sense are for a while unattainable, and the accomplishment of this great object may therefore be delayed. It is to be hoped, however, that it will not be finally abandoned.

Simultaneously with the rapid advance which has been made in the works to which I have referred, there has also been great progress in another branch of Engineering with which Civil Engineers have latterly become connected.

That new branch is gunnery. In a few years, mainly in consequence of the labours of Sir William Armstrong and of Mr Whitworth, the range of artillery has been doubled. The weight of the gun in proportion to that of the projectile has been reduced to one-half, and the capacity for powder of the elongated as compared with the round shell has been more than doubled. This great advance in the destructive power of cannon has rendered most of our old fortifications useless. New fortifications have therefore to be built, adapted to the longer range and greater destructive power of the new artillery. These fortifications require to be placed more in advance of the places to be defended, and to be constructed with very superior powers of resistance to those which hitherto have proved sufficient. The old walled towns, which were formidable enough in former days, would to-day, in case of a siege, afford little security to the inhabitants who dwell within them; the old defences, therefore, have to be removed, and replaced, where necessary, with those most suitable to modern requirements.

We are clothing our ships of war in iron mail, and it seems probable that iron in some cases will be largely used in modern fortifications. Not that earthwork and stonework will cease to be useful. These are valuable for the staple of most forts, but neither of them make good embrasures, and for that purpose iron offers great advantages. By its use greater strength can be secured at those points where power of resistance is specially wanted. By its use also the size, and consequently the exposure, of the embrasures will be diminished, and much greater facility be given for working the guns and training them through larger angles.

There are some cases, however, in which forts may with advantage be principally, if not wholly, built of iron. I hope to see that material adopted for the superstructure of the large sea-forts at Spithead, the construction of the foundations for which has been intrusted to me. There can, I think, be no insuperable difficulty in constructing iron forts so as to be impregnable to a ship's battery, though in the absence of knowledge as to what may be the ultimate powers of guns, it is not easy at present to arrive at safe conclusions. The difficulty of doing the converse of this, viz., of building ships so as to be impregnable to the fire of such artillery as may and ought to be placed in the new forts will be a problem not so easily solved.

No plated ship yet built could keep afloat under the fire of guns throwing shots of 200 to 300 lbs. weight; and it seems difficult in the case of ships which require buoyancy, sufficiently to increase the thickness of their armour-plates to keep pace with the probable advance in weight and size of the new cannon.

Naval commanders rely a good deal, and perhaps up to a certain point correctly so, on the mobility of their ships; but ships cannot be so efficient if, to prevent being struck, they be always kept moving about. If never hit, they will of course receive no damage; but if ships are to resort to such manœuvres to avoid the enemy's fire, they do not seem adapted to bring great actions to a speedy conclusion. And how are such manœuvres to be managed with damaged rudders and disabled screws? Naval engagements will, in my opinion, be settled hereafter, much as they have been heretofore—the victory will be with the heaviest metal and the greatest daring. And after the various discussions that have been raised on this point, fixed and floating batteries will be found each to have their uses; and it is, I think, a limited view of the question that leads to an undue exaltation of one over the other. If land-batteries are, as some have urged, so innocuous to ships, why was Cronstadt not taken?

A very important question, viz, the use of iron for ships and forts, and war purposes generally, is now undergoing the investigation of a committee specially appointed for the purpose, and it is to be hoped that their labours will lead to some important conclusions.

As it respects the question of armour-plates, or if iron to be used for similar purposes, it would not seem that the hardest iron will prove the most suitable, unless it be combined with the greatest toughness. The force of impact is in a sense infinite. A ball cannot be arrested instanter in its flight. The thing struck, or the ball that strikes, must, one or both, possess some elasticity or ductility, or, if not, one or both must go to pieces. Of course the object to attain, as it regards both ships and forts, will be to devise a structure that will best arrest the shot; but we have not yet arrived at the best mode of doing this.

The use of iron is extending on every side. Its manufacture is also, I am glad to say, improving. There was great room for its improvement. Several processes for converting it largely into steel, or into a metal approaching steel in character, are also now in use, and promise to afford an article at a moderate price double the strength of ordinary iron. These discoveries will tend still further to extend the use of iron.

Should it turn out that steel, or homogeneous iron as it is sometimes termed, uniform in quality, and of double the strength of ordinary iron, can be manufactured in large quantities at a moderate price, and can be easily manipulated; then, many things that are now with difficulty accomplished will be greatly facilitated, and some things which cannot be done at all will be rendered practicable.

Bridges of greater span could be constructed. Screw shafts, crank-axles, and other parts of steam-engines, at present of unwieldy size, would by its use be reduced to more moderate dimensions. There seems to be no limit to the size of guns, except that of the strength of the material, and the power of welding, forging, and handling them. Cannon, as we know, have already been greatly increased in power by adopting a superior material in their construction. Could we hit upon an inexpensive mode of doubling the strength of iron, the advantages to all sorts of machinery might be equal to those that would flow from the discovery of a new metal, more valuable than iron has hitherto been.

We are, I believe, in the infancy only of discoveries in the improvement of the manufacture of steel and iron. Until lately the nature of the demand for iron rather retarded than encouraged improvements in its manufacture. Railways consumed iron in vast quantities, and railway companies cared nothing about quality. They were driven to seek a tolerably good material for engine and carriage tyres, but as it respected the vast consumption in the shape of rails, they were implicitly guided by the lowest prices. As long as this system continued it suited the ironmaster to manufacture a cheap article in large quantities, and they therefore gave themselves no concern to establish a better state of things. But heavy engines, high speeds, and an enlarged traffic are gradually working a change. We are beginning to find that iron of the very best quality has hardly endurance enough for rails or locomotive tyres; that there is no economy in putting down rails which require taking up again in a year or two; and in short, that the increased strains arising from the accelerated motion of railways, steam-boats, and machinery generally, are necessitating a better material.

In marine steam-engines, which have received much attention, and where great attempts have been made at perfection, paddle-shafts, crank-axles, screws, and other portions have, as before intimated, already attained an unwieldy size, and the vis inertia and weight of such masses of metal are of themselves no slight impediment to the improvement of steam navigation, and would be greatly obviated by the use of a stronger material.

Fortunately for this country, just at the time that the use of iron is extending and improvements in its manufacture are developing, fresh discoveries are made of the raw material, and men seem to stumble, as it were by accident, on new fields of iron ore, in places where those mineral riches have laid dormant for centuries, to await a new era and another age, when ships like knights of old are to go forth to battle in complete armour, and when the Civil Engineer has assumed the duties which devolved on the smith and armourer of former times.

Having noticed some of the advantages that may flow from a greatly improved quality of iron or a cheap manufacture of steel, or of a metal approaching steel in character, I may call attention to the great facilities that have arisen from the use of iron cylinders in sinking and securing foundations.

Before this invention, masonry built under water had to be performed by divers with helmets, or by means of diving-bells. That mode of construction does not admit of the best work. The stones are laid without mortar, and depend for their security on their large size, and on a good arrangement of bond.

It is true that concrete work (which, however, is inferior to masonry) could be built under water without either divers or diving-bells; by passing the concrete through the water to its destination in boxes or by means of shoots, and giving it the requisite form by casings of timber or iron.

This mode of building has long been adopted on the shores of the Mediterranean, and the docks and quay-walls at Genoa have been built in this manner.

But the use of iron cylinders not only admits of masonry or brickwork being built in mortar under water in any form, and with any bond, but enables the Engineer to excavate under water, and to examine the ground before he begins to build, and to proced with his work with as much deliberation, method, and security, and almost with as little delay, when 70 or 80 feet below the water level, as he can do on dry land.

Hitherto this method has been mainly confined to the use of circular cylinders, sometimes used (as was done by Mr Brunel in the case of the Saltash bridge) as a means of building the requisite pier of subaqueous masonry, the iron being afterwards taken away, and sometimes to enable the requisite piers of concrete, brickwork and masonry to be executed, and by allowing the iron cylinders to remain afterwards to protect the interior work.

In other cases, the cylinders themselves are used to support the incumbent weight, and they then act simply as piles.

But it appears to me that this method of building may be extended with advantage much farther than it has been. It is adapted to almost any form of pier, and might in certain cases be usefully applied in building continuous walls, and I know of no system that is likely to afford greater help to the Engineer.

I have already said a few words on the progress of invention. This method of building is an illustration of the slow progress of really useful things.

In 1841 a patent was taken out for "improvements in the means of and in the apparatus for building and working under water;" and soon after the construction of the Rochester bridge, where cylinders were sunk under air-pressure, an action was brought against Messrs Fox and Henderson, the contractors for the bridge, for an infringement of that patent. I happened to be engaged on that trial; and the fact was then brought to light that many years before, the late Earl Dundonald (then Lord Cochrane), had taken out a patent for a similar purpose very perfect in most of its details, for the drawings attached to Lord Cochrane's patent showed an air-lock almost identical with that now in use, and contained all the requisite arrangements for success. Lord Cochrane proposed to use it for overcoming difficulties similar to those encountered in the execution of such works as the Thames Tunnel; he proposed, in fact, to excavate such works under air-pressure.

This is another instance of the fertility of mind of that extraordinary man, who, great as he was as a Sailor, would probably have been equally eminent as an Engineer; and I here offer as a tribute to Lord Dundonald's memory this recognition of his early attempts to introduce the important system to which I have just been referring.

But we live in an age when men's minds turn to mechanical inquiries, and when probably they were never more fruitful in mechanical resources.

It is almost needless to give examples of this fact. The Locomotive Engine is a familiar instance, and Railway machinery generally affords many illustrations. The beautiful cotton-combing machine invented by Joshua Heilman, of Alsace, which was first used in the cotton manufactories to separate the fine from the coarse fibre, and has since been applied to wool, flax, and silk, and which acts almost with the delicacy of touch of the human fingers, is another illustration. Scheutz's calculating-machine is another remarkable instance, and many other cases might be named.

There is one subject, however, connected with mechanics which has hitherto been barren of result, about which men will occasionally occupy themselves, viz., the discovery of a new motive power.

The steam-engine, however, remains the only tame giant that is usefully subject to the will of man.

The little that has been done in the way of its improvement, since it left the hands of Watt, speaks volumes to the sagacity, industry, and untiring perseverance of that great man.

The late Mr Kennedy, of Ardwick House, who was on intimate terms of personal friendship with Watt, on one of his last visits to Soho, asked him if he had discovered anything new in the steam-engine. "No," he replied, "I am devoting the remainder of my life to perfecting its details, and to ascertaining whether in any respect I am wrong." What the labours of that life produced we all know, and the patient concentration of will on his great object reminds one of Newton's similar labours in the perfection of his theory of gravitation, and evinces in the one case as in the other the truly great and philosophical mind, which is capable not only of discerning the dawnings of a great truth, and of appreciating its magnitude, but also of patiently pursuing its evidences until the whole is made clear as noon day.

At present it seems improbable, so long as motive power is to be obtained through the intervention of heat, and until a cheaper fuel than coal can be found, that the steam-engine will be superseded by any other machine.

Electro magnetic machines are perhaps the least likely of all inventions to supersede the steam-engine. The consumption of a grain of zinc, as Mr Joule has shown, though much more costly than a grain of coal does not produce more than about one-eighth of the same mechanical effect.

It would not, however, be at all safe to predict that considerable improvements may not yet be made in the steam-engine, or in engines to be worked by coal.

The consumption of fuel in the best steam-engines has been reduced to 2½ pounds of coals per horse-power per hour; but such an engine does not utilize one-fifth part of the absolute mechanical value of the coal consumed, and so long as this is the case, it would be unwise to assume that we have attained the utmost limits of improvement.

On another great branch of engineering, that of docks and harbours, I am not aware that much that is novel can be noticed.

The progress of such works is generally too slow to admit of much change in short periods of time.

An interesting discussion on the subject of harbours took place during a preceding session of this Institution. A considerable portion of that debate turned on the question of how far such works should be made permanent in the first instance, and how far they should be constructed so as to bring them into use with the greatest rapidity and at the smallest amount of cost, reckoning, of course, on rebuilding them at a future period.

This is one of those questions which it would be vain to discuss with any hope of coming to general conclusions.

In its naked form (apart from the question of harbours) it is one of the most simple and elementary questions. For it would not be difficult to show that if money alone be worthy of consideration, then as it respects public buildings of all sorts, the cheapest system would be to discard solidity and ornament, and to adopt structures of a more temporary character, the plan in fact which is always adopted in new countries.

But wealthy nations, like rich individuals, will spend more on themselves and also more on their public works and buildings than the absolute wants of a nation demand, and the fact is, that men are not governed by monetary considerations only, but also by a sense of what is or is not appropriate.

We have, however, some exceptions to this rule. There are, for instance, the tattered and ragged margins of the Thames, where, in the greatest metropolis of the world, mud banks swelter and crazy buildings reel and totter against each other, but which it is proposed at a somewhat late hour to remedy.

Having thus touched upon the several points that occur to me as deserving of notice, I will conclude by remarking that no man can look back on the last twenty or thirty years without feeling that it has been the age of Engineers and Mechanicians. The profession to which we belong has in that period of time done much to change the aspect of human affairs; for what agency, during that period, single or combined, can be compared in its effects, or in its tendency towards the amelioration of the condition of mankind, with the establishment of railroads, of the electric telegraph, and to the improvement in steam navigation?

For in constructing railways, telegraphs, and steam-boats, and their adjuncts docks and harbours, and moulding and fashioning the face of the material universe to the wants of man, in overcoming its barriers, overleaping its valleys, and spanning its seas, Engineers annihilate both space and time, bring into juxtaposition nations and people, and accelerate, beyond all human expectation, personal communication, and that interchange of ideas which is all important to the advancement of civilization and knowledge.

Distance and separation have led and will always lead to misapprehension and prejudice—to ignorance and mistrust—to rebellion and war; and engineers may feel, when labouring on the great public works that facilitate the intercourse of nations, that they are not merely conquering physical difficulties, but that they are also aiding in a great moral and social work.

January 28, 1862.

"On the Form and Materials for Iron-Plated Ships, and the Points requiring attention in their Construction," by Mr Joseph D'A. Samuda.

The author stated that, Iron-Plated Ships having now become a necessity, it was important to ascertain, first, the best description of construction of ship and armour, and secondly, the best form and dimensions of vessel.

To effect these objects, there were four indispensable conditions; first, these vessels must be of such dimensions and power, and be built on such lines, that they should always command a superiority in speed, over the best timber-built frigates afloat; secondly, they must be protected with armour over their entire length; thirdly, the armour must be so applied as to be capable of rapid replacement, or repair; and fourthly, the armour should enter into the construction of the ship, and thus give strength to the whole fabric, as well as protect it from an enemy's fire.

These conditions had only been partially attained in the vessels already constructed, or proposed to be constructed; for, the "Warrior" class obtained speed alone, the "Defence" class failed in all, the "Valiant" class only approached the second condition, and the three new ships of 6,700 tons burthen, recently contracted for, at a cost with their engines of £400,000 each, would probably possess the first and second, but not the third and fourth conditions,

Although the "Warrior" was highly creditable as a first effort, and was not defective in strength, yet it was a complicated and costly construction, and its character should not, therefore, become stereotyped, as incapable of further improvement, or as if it were not desirable to seek for it.

The author proposed, that the framework of the hull should be built as in an ordinary first-class steamer of the same size; and that outside the frame-work, and rivetted to it, there should be five longitudinal ribs, at intervals of five feet, reaching twenty feet below the gunwale. These longitudinal ribs should be of bars of rolled iron, 2½ inches in thickness and 16 inches wide, the outer 4 inches on each side being recessed 1 inch. The ordinary skin plates, 1 inch thick, were then to be rivetted in these recesses, so as to form a flat surface for the reception of the armour, each strake of which was to be made to correspond with the distance, from centre to centre, of the longitudinal ribs. The edges of the armour plates, 5 inches in thickness, were then to be bolted, or rivetted through the ribs longitudinally, the vertical butt joints of each plate, made to break joint with the skin plates, being rivetted to corresponding ribs 2½ inches in thickness, placed between the longitudinal ribs, and attached to them with fish plates. It had been determined by experiment, that this thickness of rib would be sufficient to render the edges of the armour plates, when weakened by the rivet holes, equal in strength to the central body of the plates. By this arrangement, a perfect ship, without armour, was first made; then a complete armour case was attached through the longitudinal ribs, without interfering with the joints or fastenings of the ordinary skin of the vessel. Indeed the skin would be so distinct from the armour that, in time of peace, the armour could be removed and the vessel be used as a transport, if desired. By these means the armour could be rapidly repaired at any point, and there would be no necessity for tongueing and grooving the plates, adopted as an expedient by the Admiralty, to remedy the bending up at the edges, which the present imperfect mode of fastening rendered them liable to.

Thus, protection would be obtained over the entire length of the vessel, by the armour admitting of rapid replacement, and entering into the construction of the ship. It remained only to show, what dimensions and power were necessary to secure speed. For a 32-gun frigate constructed as described, the best dimensions would be 382 feet long, 55 feet beam, and 31½ deep to the main deck; 5,600 tons burthen, and fitted with engines of 1,200 H.P., by which a speed of 15 knots an hour could be obtained, with the armament ammunition, and coal on board, and sills 9 feet above the water line. Such a vessel would have even greater speed than the "Warrior," and be wholly protected over the entire length of the sides.

As the importance of complete protection had now been recognised by the Admiralty, it was desirable to compare this armour-skin vessel, of 5,600 tons burthen, with those now building. The Admiralty vessels were to be 6,700 tons burthen and 1,250 H.P. but they would not be able to carry a heavier armament, or possess a higher speed than the proposed vessel. They would be less manageable, form larger objects to fire at, and cost £400,000 each instead of £340,000, or in a fleet of twenty-four such frigates, one million and a half pounds sterling more.

For coast defences, vessels might be built, protected from stem to stern, having a length of 200 feet, beam of 48½ feet, depth of 25 feet, burthen of 2,200 tons, and engines of 350 H.P., pierced for thirty-two 68-pounder guns but carrying only sixteen, with a draft of water of 16 feet, when the guns, ammunition, and coal were on board, and capable of attaining a speed of 11 knots an hour.

In conclusion, the author thought that the time had arrived, when the Admiralty should see the propriety and the advantage to the public service of abandoning the monopoly of restricting all advance in the construction of mail-clad vessels to plans and systems emanating from themselves; and that it would be far better to trust to the engineering skill of this country, leaving it free to take the initiative in improving this branch of National Defence, and the Admiralty only exercising a veto within such limits as experience fitted them to form a judgment upon.

The discussion upon Mr Samuda's Paper "On Iron-Plated Ships," which was commenced, was resumed at the next meeting, Tuesday, February 4, and again adjourned to Tuesday, the 11th February.

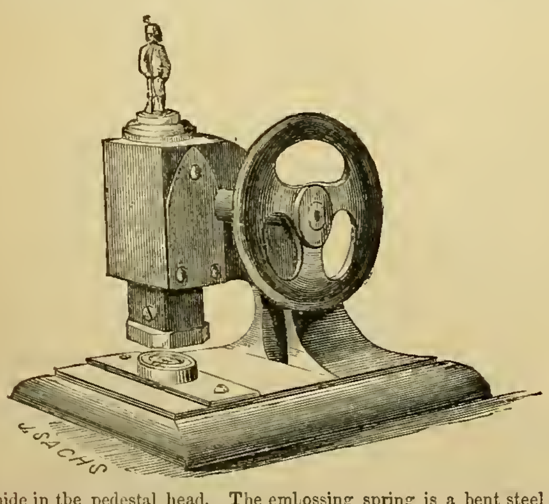
Several different methods in details of attachment of the armour plates to the ship's side were brought forward by Mr Cooper, Mr Gibbs, and others, and a model of an invulnerable ship of combined timber and iron, by Mr Turner of the Admiralty; nothing, however, either of much novelty or value, up to the conclusion of the second night's discussion.

MONTHLY NOTES.

M. Le Main has communicated some interesting, and if fully sustained hereafter, most important facts, as to the effect of coal tar in arresting or preventing the potatoe disease. He states that an extremely small proportion of coal tar mixed up with the soil, more and more being added, with constant agitation, until the mass becomes friable and pulverulent, and this scattered on the surface and dug in, becomes an absolute preventive or prophylactic of the potato disease. If so, there can be little doubt it is due to the creosote contained in the tar; from the extreme diffusibility of its odour, and the well-known absorptive properties of the soil, it would appear, a priori, a very probable agent to produce the results attributed to it, and seems well worthy the trial of our own experimental agriculturists.

Lighting and Heating Railway Carriages.—Now that it is customary to have so much night travelling by railway, we find out how objectionable it is to have to endure what is merely darkness illuminated, inside the carriages. Gas has often been proposed as a remedy for the grievance, and Mr Newall of Bury, has recently applied his plan of gas lighting to several of the passenger trains on the Lancashire and Yorkshire line. The particular trains to which Mr Newall has supplied his plans, are the fast trains between Manchester and Bradford, and Manchester and Blackpool. The London and North Western Company, are also about to adopt the system in some of their fast trains, and in particular, to the limited express between London and Holyhead. The gas is compressed by hydrostatic pressure within the compass of a small box, which can be carried conveniently in the guard's van, and the light produced seems to be all that can be desired. The plan of heating the carriages by steam from the engine, has now also been fully tried, and found to answer perfectly. If lighting, heating, and ventilating, are properly carried out as they are now proposed to be, night and winter travelling will be robbed of a vast proportion of its disagreeables.

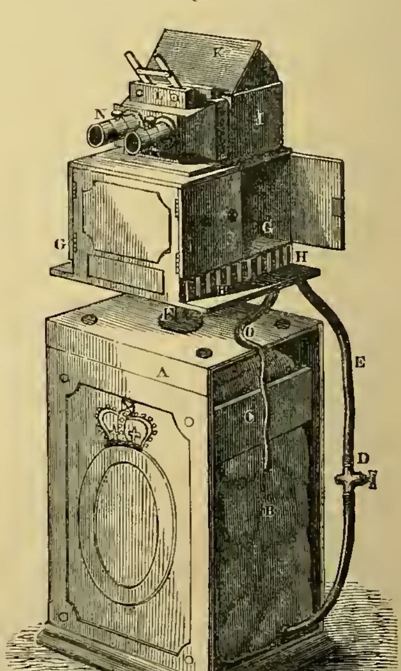
Percussive Action Embossing Press.—The perspective sketch annexed is a half-size representation of a very simple and convenient embossing press, introduced by Mr Jones, of High Holborn, London. It operates entirely by impact, unlike the ordinary embossers which act by simple pressure. It consists of a small rectangular base plate, with a hollow curved overhanging pedestal arm cast upon its upper surface. The upper portion of this pedestal carries the bearings for a short horizontal operating spindle, carrying an overhanging hand-wheel. On this spindle, and in the interior of the pedestal, there is a small lifting cam for working the vertical embossing bar, which traverses in a guide in the pedestal head. The embossing spring is a bent steel blade, wholly within the pedestal. It is screwed at its lower end to the base of the press, and its upper free end is entered into a recess in the die bar. As the hand-wheel is turned, the cam, acting against the lower side of a lateral pin in the die bar, elevates the latter, so as to leave space between the face of the bar and its counterpart or "force" on the base, for the insertion of the paper to be embossed. When so raised, a slight spring detent, carried on the top of the pedestal, operating on the "half-cock" action principle, secures the die bar at this elevation. Then, as the hand-wheel is turned further round, the detent releases its hold upon the bar, and the die then comes down with all the impact due to the pressure of the operating spring. Even in the small size of press which we have engraved, the impression produced is wonderfully sharp, and as the press is actuated in so excessively simple a manner, it must be a very useful adjunct to the office and library.



Chemical Agriculture.—M. Albert le Play has presented to the Institute of France, an interesting memoir containing his chemical researches to discover the source whence the vegetation found in crops &c., in the primitive formation of the Limousin assimilate their indispensable proportion of lime. He points out the extreme sterility of the region, and shows that it is due to the nature of the soil produced by the decomposition of gneissose rocks, and has proved by analysis that the surface soil does not contain a particle of lime. He finds that under the influence of the ordinary agents of atmospheric decomposition, the mica, the quartz, and the orthose felspar remain unaltered, but the anorthose felspar, composed of silicates of alumina, potash and soda, of lime and magnesia, becomes disintegrated and pulverulent. The anorthose forms the major part of the silicates of the rock fortunately. This disaggregated pulverulent material is acted on by rain water, holding certain acids &c. in solution, and the silicates separate into two groups. The silicate alumina remains insoluble, while the alkaline, magnesian and calcareous silicates dissolve. In the deep clays, which form much of the beds of soil, these are carried down in solution, and the lower the soil is penetrated by the plough &c., the more appreciable are the traces of lime in it. The rain water of this vast district, to which so much of the central plain of France is analogous geologically, is thus its great and indispensable fertilizing agent. The author points out, how immediately his refined researches bear upon agriculture, that *deep* ploughing is important, and that rain water should be applied to the land, after having drained deeply through it, and so become again encrusted with fertilizing matter—that here is in fact a case, where irrigation is of first importance. There are many parts of our own country in Scotland, the North of Ireland, and the Channel Islands, to which those results are directly applicable and of importance.

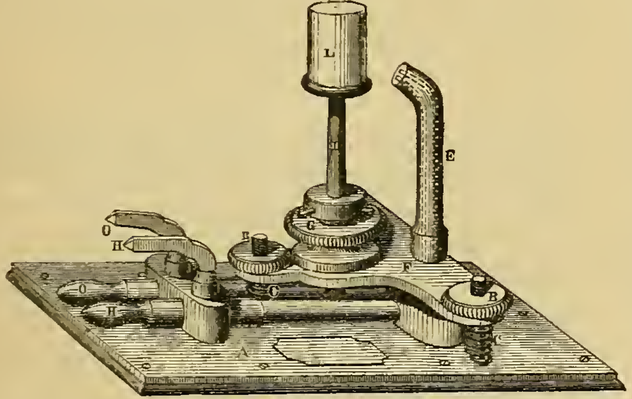
Achromatic Bi Lens and Safety Light Apparatus for Dissolving Views.—The new arrangements of lens and light apparatus for dissolving views, represented in our two perspective illustrations, are by Mr Warner of Fleet Street, London, and are most judiciously adapted to their intended purpose. Fig. 1 represents the apparatus complete. It consists of a light wooden case, A, forming a base for the optical arrangement and receptacle for the oxygen bag, B, which, when filled with gas, occupies the whole of the space within, excepting that taken up by the smaller bag, C, and holding sufficient quantity for an exhibition of two hours. The bag, C, which is used for giving the pressure, may be filled or partially filled with water, according to the weight required, and thus avoid the necessity of carrying the heavy iron weights usually employed for that purpose. When the apparatus is in use the weight follows the bag in its downward course as the gas is withdrawn through the stop cock, D, and connecting tube, E, keeping up a steady and uniform pressure throughout. Supported above this case is another and smaller case, G, which can be adjusted to the required height by means of the elevating screw, F, upon which it rests, giving the exhibitor a ready and efficient means of centering the picture on the screen without placing the whole apparatus at an angle and thereby distorting the picture. Fixed on the top of this case is the mahogany lantern, I, carrying the two safety hydro-oxygen burners, improved arrangements of condensing lenses and achromatic powers, N, which allow of the apparatus being used at a short or long distance from the screen according to the size room in which the exhibition is to take place. The whole of the adjustments to the lights, pictures dissolver and powers are arranged to be worked from one side, thus avoiding

Fig. 1.



the necessity for passing and repassing the apparatus while working. The improved dissolver, L, is placed between the lenses and worked by levers which admit of the lanterns being used either together or separate, and enabling the exhibitor to make the most rapid changes and startling effects ever produced. The jointed top, K, is raised, as shown in fig. 1, for the purpose of carrying away the slight heat occasioned by the combustion of the gases. The views having been framed to suit the apparatus are packed away in the lower partition H, of the case, G, in the order in which they are to be shown. The simplicity of this apparatus is greatly owing to the improved mode of burning the mixed gases, namely, that of conveying them through separate compartments into the open air, and causing them to emerge at two such angles as will ensure perfect combustion, there being no possibility of the gases returning through the tubes. One bag only for the oxygen will be required, the hydrogen tube being stretched over the nearest gas burner at hand, making the whole apparatus much more portable that it otherwise would be. Fig. 2 represents the safety hydro oxygen burner arrangement in detail. The arrangement and management of this burner is exceedingly simple in all its parts, consisting only of the two tubes and stop cock, H and O, fixed into a brass bush under the triangular plate, F, the ends of the tubes corresponding with separate passages through the upwright tube, E, and terminating in two angular jets through which the gases make their exit, thereby preventing the possibility of their mixing until in the open air, and entirely avoiding all risk of explosion. Into the base plate, A, is inserted three brass screws, over which are three spiral springs, C; upon these rest the triangular plate, F, which carries the burner and lime holder, secured by the three nuts, B. The whole arrangement being now supported upon three points can be moved either vertically or horizontally, as may be required for the purpose of accurately adjusting it to the centre of the lenses, by means of the three springs and nuts which keep it perfectly rigid in any position it may be set. The lime holder is provided with the clamp nut, G, for the purpose of securing it at the required distance from the jets, and can be raised or lowered by the screw attached to the spindle, D, and passing through the clamp nut, G. The hydrogen and oxygen gases being of two different densities, it has been found necessary to bring them into the open air at different angles as the only means of producing perfect combustion. Having found it to be of the greatest importance that this exact angle should always be retained in the manufacture of these burners, Mr Warner has arranged an apparatus for the express purpose of drilling them so as to ensure an equal quality of light from each.

Fig. 2.



Irish Coal Mining in Westphalia.—In the last part of the Bulletin De la Society de l'Industrie Minerale, Tom. vi. 4 "livr.," a full and interesting account is given from the pen of Baron Ducker, Roy. Mining Engineer of the Prussian Kingdom, of the coal mining operations near the River Ruhr, a branch of the Rhine in Westphalia, of an Irish company of "adventurers" whose operations commenced in 1855. The company was formed under the advice of Mr Wm. T. Mulvany, C. E., and formerly Commissioner of Arterial Drainage in Ireland, and a member of the Irish Board of Public Works, and the works have throughout been conducted under his direction, and under him have become eminently successful. Two shafts of nearly 12 feet and 10.4 feet English diameter, but of no very great depth, (120 fathoms,) have been sunk to the coal winning, through extremely bad and wet ground, by the usual method of cast iron tubbing employed in Northumberland, and by the aid of workmen from Newcastle; and from these shafts about 2000 tons per day are now raised and sold at a profit more than double the average netted on coal in English collieries. These methods so familiar to us in England, appear to have been absolutely new (so far as the use of cast iron for the tubbing, and of the usual tackle of sinking-sets of pumps are concerned,) to Prussian mining engineers, and an elaborate set of plates of the apparatus employed accompany the account of Baron Ducker. It is pleasant thus to see another example of British ability and energy, succeeding in a foreign land, although not in this instance, without some misgiving of regretful thought to any who know the circumstances under which Mr Mulvany expatriated himself, after having, some years since, been made the scape goat of the Irish Government of that day and of its departments, whose moral cowardice recoiled at the hungry howl of bankrupt landlords driven to despair by the effects of the potato famine, and determined by any means to get free of past drainage liabilities, and put an end to all future expenditure whether advantageous or not. Nowhere is the progress of mining industry so brilliant, and its productive results so encouraging of late years, as in this district of Westphalia, where coal workings, iron works, steel manufactories, like the now great works of Mr Krupp of Essen, and many manufactures and arts dependent upon cheap fuel, have become rapidly and extensively developed. Evidences of what has been done here, and of what the region is by nature capable of yet affording to be done, will, no doubt, be forthcoming at the approaching international exhibition.

The New Alkaline Metals, Cæsium and Rubidium.—Cæsium and rubidium are the names of the new alkaline metals discovered by spectrum analysis by MM. Bunsen and Kirchhoff. M. Grandeau, who has been engaged on the subject, states that he has had the advantage of making his researches almost under the eyes of M. Bunsen. M. Grandeau began by examining the various mineral waters and minerals, presenting some analogy with the waters of Durkheim, which have yielded cæsium; and with the lepidolite of Rozena, from which the illustrious chemist of Heidelberg has extracted rubidium. The mother waters of the salt-pits of the basin of the Meurthe, of the Mediterranean, the ocean, the Dead Sea, and the mineral waters of Bourbonne-les-Bains and Vichy, were successively subjected to analysis. Sea water and the salt water of the Meurthe only yielded lithia; that of the Dead Sea, lithia and strontian; but the waters of Vichy, of which several thousand litres had to be evaporated, yielded about two grammes of the double chloride of platinum and cæsium, and another of platinum and rubidium, the proportion of which was not ascertained. The quantity of the new alkalies contained in the waters of Vichy is, therefore, very small; but forty hectolitres of the waters of Bourbonne-les-Bains yielded, besides chloride of sodium, various calcareous salts and lithia, a considerable quantity of the chlorides of cæsium and rubidium. Some years ago, M. Troost had prepared several kilogrammes of salts of lithia, and preserved all the residues. These, examined by M. Grandeau, furnished him a considerable quantity of a mixture of the two alkalies in nearly equal proportions. The same result was obtained from a lepidolite of Prague, infinitely richer in cæsium than that of Rozena. Lastly, among the artificial productions examined there were the residues of the saltpetre manufactory of Paris. From these Captain Caron had extracted by treatment with a salt of platinum, considerable quantities of the new metals in which they were discovered by M. Grandeau in equal proportions. The refuse of a Belgian saltpetre manufactory contained much rubidium without a trace of cæsium. From all this it would appear that the two new elements are much more widely diffused through nature than was previously suspected. [These results curiously illustrate the wisdom of the saying attributed to the ancient chemist, Glauber, (from whom our "Glauber salts" takes its name,) that he made his discoveries by carefully examining what every body else had thrown away.']—Ed., *P. M. J.*

Aquarium at the Jardin d' Acclimatation.—The aquarium constructed by Mr Alford Lloyd, at the Jardin d' Acclimatation, in Paris, is the largest ever constructed, being 40 metres in length and 10 in breadth. The compartments have received a northern exposure, to avoid the inconvenience of having the temperature of the water too much heated by the rays of the sun; and for the same reason no windows have been pierced through the southern wall, so that the aquatic animals enjoy all the desirable coolness, while the spectator has the advantage of a subdued light necessary for distinct vision. The quantity of sea-water employed in the 10 compartments reserved for marine animals is about 22,700 litres; and this water is never changed; it is only made to circulate incessantly in the compartments by means of pressure obtained in the following manner:—A current of water obtained from the supply of the Bois de Boulogne is made to compress a certain volume of air, which in its turn exercises a pressure on the sea-water contained in a close pipe situated below the level of the aquarium; by this pressure the sea-water is made to rise, and to enter, charged with air, into the compartments, while an equal quantity of water flows off through a waste-pipe, whence it passes to a filter, and to a subterranean reservoir, whence it returns to the compartments as above described. Besides this method of providing the inmates of the aquarium with the oxygen necessary to maintain life, another is employed,—viz., the vegetation of plants, which, while they absorb the carbonic acid produced by respiration, emit oxygen at the same time. There is also a contrivance in the aquarium for raising or lowering the water in the compartments, so that an artificial ebb and flow may be produced. The diminution of the sea-water caused by evaporation is remedied by the addition of river water, which is sufficient, as the saline ingredients do not evaporate. Mr Lloyd advises the public not to feel disappointed at the absence of large fish or crustacea in the aquarium, since such creatures would require a compartment to themselves, to prevent their committing havoc among their smaller companions. Again, the inmates of the aquarium must not be frequently changed, the object being precisely to have the same individuals before our eyes in order to study their habits. Lastly, the aquarium, like everything else, requires time in order to arrive at perfection, since vegetation is necessary, but is not and cannot be ready at command.

What is made of the Soil in Holland.—Every year strengthens our conviction that the mechanical engineer will form a far more intimate connection with the scientific cultivation of the soil, than he has hitherto established. He has, in reality, only just begun to see that he has somewhat more of a duty to perform toward the earth from which he sprang, which directly supports him, and which will finally receive him, than he has hitherto suspected. When we see what vast changes for the better have been effected upon the soil by sheer application alone, and with few or none of the advantages which mechanical science has every where else so thickly distributed, we are forced to the conclusion that a magnificent scope is now opening up for the engineer in connection with the farmer. It is this partnership, as we may term it, which will alone ultimately place the farm on a level with our other highly elaborated scientific manufacturing projects. Look at what has been done in Holland where machinery proper, except that appertaining exclusively to drainage works, is barely known on the farm. From Holland we draw a vast amount of our *articles de consommation*, and it is a matter of no small importance to ascertain exactly how the country stands in reference to its productice powers, seeing that it can afford to send us so much of what with all our applied science we cannot produce ourselves. The superficial area of the Netherlands is estimated at nearly 8,000,000 statute acres, of which 1,722,500 are under tillage, 2,968,200 in pasture, 555,400 in wood, and 1,747,000 on uncultivated land. The rising price of agricultural produce and the increase of population have of late years greatly encouraged the application of labour and capital to the reclaiming of heath or bog-land, and continued additions are made by the artificial means of enclosure from the sea and from the estauaries of the great rivers. No portion of the soil of the kingdom is placed beyond the possibility of being reclaimed by its elevation, since the highest ground in it, with the execption of a very small portion in the southern part of Limburg, does not exceed 360 feet above the mean level of the sea. The manner in which the land is protected from the irruption of the waters by dykes is too well known to need description here. The products of the soil are in the main similar to those of the British isles; some valuable crops, however, which are either unusual or altogether unknown to us, such as madder, tobacco, hemp, and chicory, are to be found in the Netherlands. Rye is the grain most raised, occupying an extent of land in proportion to that sown with wheat, barley, and oats together, as eight to nine, and furnishing the principal food of the lower orders, as well as a considerable portion of the ardent spirits they consume. It is estimated that the quantity of grain grown in the Netherlands is adequate to the consumption of the country, in the shape of food, for the population of three million and a-half. The average production of wheat to the acre appears to be 21 bushels, oats 33½, barley 29, and rye 15 bushels. Buckwheat is an extensive crop; the annual produce 3,132,000 bushels, acreage yield nearly 21 bushels. The quantity of potatoes grown in 1859 was 31,000,000 bushels, and the average per acre 121 bushels. About 2,000,000 bushels of coleseed are raised, the yield being about 25 bushels to the acre. Root crops are receiving more attention. The average yield of mangel-wurzel is 10 tons the acre; of clover 1½ ton. A large smooth-seeded variety of spurrey is cultivated to the extent of about 50,000 acres, being found superior to other pasture grasses in remaining green till a late period of autumn, and often throughout the winter, and it yields 2½ tons to the acre. It is the most nourishing, in proportion to its bulk, of all forage, and gives the best-flavoured milk and butter. Spurrey has been recommended for culture in England, but such a plant would never pay the expense of seed and labour even on the poorest soil in this country, for we have many better plants. Chicory averages about 7½ tons to the acre in Holland, and tobacco in Utrecht about 1½ tons per acre. On a heavy clay alluvial farm in North Brabant, cultivated upon an improved rotation system, the average yield per acre for ten years was—wheat 31 bushels, rye 35¼, barley 54½, oats 65½, beans 42½, peas 28, coleseed 26 bushels, flax £11 3s. 6d. per acre, madder 2 tons, mangel-wurzel 21½ tons. One piece of ground yielded in 1857 at the rate of 32 tons 16 cwt. of mangel-wurzel per acre. In south Holland, pasture land not in the immediate vicinity of a large town lets from 31s. to 34s. an acre. Close to the Hague, grass land belonging to the corporation pays a net rent of £5 an acre after deducting the land-tax and polder (or drainage) expenses, which together amount to about 9 per cent. on the gross rent. A farm in a newly-reclaimed polder, in the same province, about four or five leagues distant from several towns of large population, of 188 acres, is let at £196. The highest rent paid in Zeeland is 44s. per acre. In Friesland, arable land on the clay brings from 68s. to 102s., pasture from 34s. so 68s., on the sand 24s, to 34s., land from which turf has been dug 14s. to 24s. In Groningen, clay land arable lets for 27s. to 75s., sandy soil 24s. to 41s., turf-land for the buckwheat crop 88s. to 96s., and the best grass-land at 81s. the acre. In North Holland, good land favourably situated brings from 48s. to 84s. for grass, and the best arable 72s. to 132s.; while garden ground in the neighbourhood of Haarlem, where a large quantity of flower roots is raised for exportation, lets as high as £12 an acre. The live stock in Holland in 1859 consisted of the following: horses 236,732, horned cattle 1,232,199 (of which 884,946 were cows), asses and mules 3,000, sheep 795,897, pigs 259,031, and goats 111,404. The very large proportion of cattle to other animals is a noticeable feature. Facts such as these should be kept in mind fully as much by the engineer as the farmer, for they afford the former a good idea of what he may hope to do for the tiller of the soil.

APPLICATIONS FOR

PROVISIONAL PROTECTION FOR INVENTIONS

UNDER THE PATENT LAW AMENDMENT ACT.

☞ When the city or town is not mentioned, London is to be understood.

11th December, 1861.

3101. Marc A. F. Mennons, Rue de l'Echiquier, Paris—Improvements in jack machinery for moving heavy bodies.—(Communication from Felix Winand, Goffontaine-Fraipont, Belgium.)

3102. Henry Tanner and William Proctor, Bristol, Gloucestershire—Improvements in the method of applying manure to growing crops, and also in the machinery or apparatus to be employed for such purpose.

3103. William Clark, Chancery Lane—Improvements in stoppering bottles and other vessels.—(Communication from Victor H. Solon, Boulevart St. Martin, Paris.)

3104. William C. S. Percy, Manchester, Lancashire—Improvements in machinery for making bricks, tiles, pipes, and other articles formed of plastic materials.

3105. Joseph Schloss, Cannon Street—An improvement in forming the leaves of albums and books for containing photographic portraits and views.—(Communication from Simeon Schloss, Paris.)

3106. Richard A. Brooman, Fleet Street—A method of treating teazles or thistles to be used in the teazling of cloths and stuffs and otherwise.—(Communication from Adolphe A. Gohin, Vire, France.)

3107. Richard A. Brooman, Fleet Street—Improvements in decorating or printing upon china, porcelain, earthen and other like wares.—(Communication from Joseph R. Prevost, Paris.)

3108. William H. Tooth, Rhodeswell Road, and William Yates, yr., Parliament Street, Westminster—Improvements in the manufacture of iron and steel, and in the machinery, apparatus, or furnaces used therein, and for the production of gas to be employed in such manufacture.

3109. John Potter, Leeds, Yorkshire—An improved mode of jointing or connecting telegraph wires, which is also applicable to jointing or connecting signal wires, fencing wires, and other wires or rods.

3110. John Leeming, Bradford, Yorkshire—Improvements in looms for weaving.

12th December, 1861.

3111. Richard Searle, Woodford Wells, Essex—Improvements in the treatment, preparation, and combination of metals used for sheathing ships and marine erections, also for roofing buildings and other purposes.

3112. Marc A. F. Mennons, Furnival's Inn—An improved means of defecating and purifying cane and other saccharine juices.—(Communication from Louis M. A. A. de C. de la Villeneuve, Caen (Calvados), France.)

3113. William Lightfoot, Harwell, Berkshire—An improved bridle.

3114. William W. Godfrey, Whiskin Street, Clerkenwell—A shield protector for Albert guards.

3115. William E. Wiley, Great Hampton Street, Birmingham, Warwickshire—An improvement or improvements in pencil cases and holders for crayons and other solid writing or marking materials, which improvement or improvements may also be applied to crochet needle holders.

3116. Robert Mushet, Coleford, Gloucestershire—An improvement or improvements in the manufacture of iron and puddled steel.

3117. William S. Longridge, Alderwasley Iron Works, Derbyshire—Improvements in railway wheels and tyres.

3118. Augustus Tonnar, Eupen, (Rhenish Prussia)—An apparatus for the drying and cleansing of malt as well as any other species of grain and seed intended for brewing, distilling, and agricultural purposes.

3119. John W. Scott, Worcester—Improvements in wads for fire-arms.

3120. Joseph D. Jobin, South Island Place, Clapham Road, Surrey—Improvements in locomotive engines, parts of which improvements are also applicable to marine and stationary engines.

3121. Henry Bailey, Trump Street, Cheapside—An improved button or stud.

13th December, 1861.

3122. Richard Ashworth, George Shepherd, John Cormack, and John Dearden, Stacksteads, Lancashire—Improvements in looms for weaving.

3123. Stephen B. Hewett, Railway Cottage, Fairfield Road, Bow—Improvements in the construction of boilers or generators for steam engines and other uses, applicable also to evaporators, and in pumps used therewith or otherwise used, some of which improvements in pumps are applicable to pistons and piston rods generally.

3124. William Bell, Leamington, Warwickshire—Improvements in kitcheners or cooking ranges.

3125. Frederick Brampton, Birmingham, Warwickshire—An improvement or improvements in the manufacture of the middle joints of measuring rules.

3126. Henry J. Olding, Smith Square, Westminster—Improvements in the mode of and apparatus for feeding steam boilers, also in apparatus for supplying fluids for other purposes, and in apparatus for raising fluids.

3127. Edward C. B. de Beaulieu, Avallon, Yonne, France—Improvements in the manufacture of spirituous liquors, and in apparatus employed therein.

3128. Gregory Bird, Glasgow, Lanarkshire—An improved lubricating grease.

3129. John W. Friend, Freemantle, Southampton—Improvements in apparatus for registering the depth and flow of liquids, and the distances run by ships at sea.

3130. Thomas Walker, Birmingham, Warwickshire—Improvements in means or apparatus for indicating the speed of vessels, and for taking soundings.

3131. Thomas B. Gibson, Glasgow, Lanarkshire—A new or improved ornamental fabric.

3132. Sylvanus Padley, Swansea, Glamorgan—Improvements in paddle wheels.

3133. Pierre Quantin, Bouscat, near Bordeaux, France—Manufacturing moulded earthen or stoneware cross sleepers for superseding wooden ones in the construction of railways.

3134. Thomas Cabourg, Bridge Street, Blackfriars—Improvements in screwing leather for the manufacture of shoes and for other purposes.

3135. Alfred V. Newton, Chancery Lane—An improved arrangement of fire escape.—(Communication from Aaron Shute, Flushing, State of New York, U.S.)

3136. John Hetherington, Manchester, Lancashire, Thomas Webb, Uttoxeter, and James Craig, Tutbury, Staffordshire—Improvements in machinery or apparatus for spinning and doubling cotton and other fibrous materials.

3137. Henry Appleby, Tavistock Place, Plumstead Common, Kent, Henry Harrison, Northampton—Improvements in machinery for boring wood and other materials used in the manufacture of brooms and brushes.

3138. Thomas K. Adkins, Wallingford, Berks, and John Bonthron, Regent Street—Improvements in the manufacture of starch and in apparatus employed therein.

3139. John Kelly, Brook Lodge, Roscommon—Improvements in the treatment of milk for the manufacture of butter and in apparatus for the same.

3140. Richard A. Brooman, Fleet Street—Improvements in and apparatus for the production and application of motive-power.—(Communication from Felix A. T. de Beauregard, Paris.)

3141. Richard A. Brooman, Fleet Street—Improvements in blowers or apparatuses for superheating steam and other gases, and for projecting them combined with atmospheric air upon ignited combustible matter.—(Communication from Felix A. T. de Beauregard Paris.)

14*th December*, 1861.

3142. Eduard C. B. de Beanlieu, Avallon, Yonne, France—Improvements in apparatus for extracting gold dust from auriferous sands.
3143. Jacques E. Duyck, Tutsham Mills, West Farleigh, Kent—Improvements in the expression of oil from cake and seeds, and in apparatuses employed therein.
3144. Ferdinand Kohn, Southampton Terrace, Waterloo Bridge—An improved mode of copying writings, drawings, prints, and similar objects.
3145. Colin M'Dougall and Joseph Crane, Manchester, Lancashire—Improvements in raising and supporting ladies' dresses.
3146. William R. Rogers, Gray's Inn Road—An improved mode of constructing dovetail joints.
3147. William E. Debenham, The Terrace, Kensington Gardens Square—An improved plate holder for photographic purposes.
3148. William Husband, Hayle, Cornwall—An improved water safety valve.
3149. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in railway rolling stock.—(Communication from Thomas J. Thompson, Logrono, Spain.)
3150. Emile Cajoz, St. Servais, (Belgium)—Improvements in the treatment of pyrites for the manufacture of iron.

16*th December*, 1861.

3151. John Willis, jr., Newcastle on-Tyne, Northumberlandshire—Improvements in the preparation of materials applicable to the manufacture of paper.
3152. George P. Vallas, Kentish Town Road, Comden Town—Improvements upon or additions to certain description of baths with the object of rendering them available for use as trunks or boxes.
3153. George Davies, St. Enoch Square, Glasgow, Lanarkshire—Improvements in the manufacture of textile materials.—(Communication from Alois C. A. de Welsbach, Vienna.)
3154. William Bartram and William S. Harwood, Sheffield, Yorkshire—An improved apparatus for filling and ramming cartridges for breech-loading and other fire-arms.
3155. David Chalmers, Glasgow, Lanarkshire—Improvements in looms for weaving, and in the manufacture of cloth therefrom.
3156. John Aitken, Lasswade, Edinburgh—Improvements in supplying water to water wheels.
3157. William G Laws, Tynemouth—Improvements in railway point signals.
3158. Charles Baumann, Altdorf, Weingarten, Wurtemberg—Improvements in buttons.

17*th December*, 1861.

3159. Walter H. Tucker, Fleet Street—Improvements in locks.
3160. John W. Chalfont, Denmark Grove, Islington, and David Keys, Craven Street, Strand—Improvements in winding up fusee watches and pocket chronometers, and setting the hands without key.
3161. John B. Bunney and Thomas Wright, Birmingham, Warwickshire—Improvements in ornamenting metallic and non-metallic bedsteads and other articles made principally of metallic rods or tubes.
3162. Robert Shaw, Marple, Cheshire—Certain improvements in carding engines.
3163. John Dale, Manchester, Lancashire—Improvements in the manufacture of glue or size.
3164. Alfred V. Newton, Chancery Lane—Improved hoisting apparatus.—(Communication from John J. Doyle and James Christison, New York, U.S.)
3165. John Platt and William Richardson, Oldham, Lancashire—Improvements in machinery or apparatus commonly called "gins" for cleansing cotton from seeds.

18*th December*, 1861.

3166. Robert Seott, Great Portland Street—An improved method of rifling or grooving the barrels of fire-arms and ordnance.
3167. Samuel Sheppard, Birmingham, Warwickshire—A new or improved tap or stop cock.
3168. James Perrin, Hyde, Cheshire—An improved equilibrium valve.
3169. Matthew Cartwright, Carlisle, Cumberlandshire—Improvements in the manufacture of beds or palates for the reception of artificial teeth.
3170. William Dicey, Waltham Abbey, Essex—Improvements in submarine electric telegraphic cables.
3171. Asmus Petersen, Wittkiel, Angeln, Duchy of Schleswig—An improved system of drainage and irrigation for meadow and other land.
3172. Morris Hanff, Tottenham Street, Tottenham Court Road—Improvements in the manufacture of boxes and cases.
3173. John Piddington, Gracechurch Street—Improved condensing apparatus for steam engines.—(Communication from Wilhelm Winter, Charlottenberg, near Berlin, Prussia.)
3174. Joseph Thiebaut, Mile End—Improvements in the ornamentation of textile fabrics.
3175. Charles E. Symonds, Stone's End, Southwark—Improvements in the treatment and application to various useful purposes of certain organic compounds.
3176. Edmnnd Pace, Queen Street—An improved lath for venetian blinds.
3177. Jean M. H. A. Taurines, Paris—Improved mode of constructing balances, weigh bridges, and other weighing machines.
3178. James Bannehr, High Street, Exeter—Improvements in apparatus for desiccating grain, seeds, and other articles.
3179. Charles Pontifex, Shoe Lane—Improvements in refrigerators for cooling worts or other liquors.

19*th December*, 1861.

3180. William Betts, Wharf Road, City Road—Improvements in the manufacture of coverings for the ends of cigars.
3181. Theodore Bourne, Charlotte Street, Bedford Square, W.C.—Improvements in cotton gins.—(Communication from Hiram W. Brown, New York. Jersey, U.S.)
3182. William Tate, Horeley Hill, near South Shields, Durham—Improvements in armour, and in making and applying the same for protecting wood and iron ships of war and batteries.
3183. Eli Stott, Ashton-under-Lyne, Lancashire—Improvements in apparatus used for collecting and removing the waste and dirt which occurs in the process of spinning cotton and other fibrous materials.
3184. Joseph H. G. Wells, Sandhurst Villas, Binfield Road, Stockwell, Surrey—Improvements in pumping elastic fluids.
3185. Alphonse Treuille and Francois X. Traxler, Chancery Lane—A safety paper intended to prevent any forgery and fabrication of shares, bank notes, checks, bills of exchange, stamped paper, postage stamps, &c., and preventing likewise all alterations and falsifications of public and private writs, the same process being also applicable to the manufacturing of playing cards, and other cards or tickets made use of by railway companies and other administrations, public or private.—(Communication from Joseph P. Olier, Paris.)

20*th December*, 1861.

3186. William Makin, Attercliffe, Sheffield, Yorkshire—Improvements in the manufacture of cast steel, mill chisels, and other taper tools and files.
3187. James Standfield, Aylsford, Kent, and John Standfield, Stratford, Essex—Improvements in machinery or apparatus for giving motion to ships and machinery and for raising water.
3188. John Smith, yr. and John B. Higgs, Coven, Staffordshire—Improvements in thrashing machines and in mills for grinding, and in raising or moving grain in granaries and other places.
3189. Charles E. Wilson, Monkwell Street, Falcon Square—Improvements in collars for gentlemen's, ladies', and children's wear.
3190. Ormrod C. Evans, Whitton, Twickenham—Improvement in sewing machines.
3191. Joseph Westwood. Poplar—An improvement in the construction of hydraulic presses.
3192. Gustave Niay, Fauhourg Poissonniere, Paris—An improved method of utilising bags, wrappers, or other similar articles made of paper or other materials, and in any form.
3193. George Walkland, Saint-Pierre-les-Calais, France—An improved machine for winding lace or other similar fabrics or tissues on cards or other materials.
3194. William Tipple, Clarence Place, Gravesend, Kent—Improvements in paddle wheels for the propulsion of ships and other navigable vessels.
3195. Vasco d'Almeida, Nottingham Street, Marylebone—An improved mode of obtaining colouring matter applicable for dyeing skins, silk, wool, and other fibrous materials.—(Communication from Edward Smith, Place Cruzquebrada, Lisbon.)
3196. William Clark, Chancery Lane—Improvements in apparatus for the manufacture of matches.—(Communication from Messrs Francis Lavallée and Son, Boulevart St Martin, Paris)
3197. John Redfern, Hanley, Staffordshire—Improved apparatus for raising the temperature of air in order to warm churches, conservatories, houses, and other buildings or places.
3198. Richard A. Brooman, Fleet Street—A new or improved method of preparing silk fabrics to be employed in the manufacture of hats, caps, and bonnets.—(Communication from Louis Bayard, Paris)
3199. Eugene E. Pereau, Moorgate Street—An improved composition for cleaning and revivifying woollen cloths and other fabrics, and the colours thereof.—(Communication from Alfred Thomas, Paris.)
3200. Robert Wailes, Brighton, Sussex—An improved tool or apparatus for cleaning windows and glasses.
3201. Thomas Green, Leeds, Willoughby Green, Brunswick Place, Leeds, and Robert Mathers, Trafalgar Street, Leeds, Yorkshire—Improvements in lawn mowing, rolling, and collecting machines.
3202. George T. Bousfield, Loughborough Park, Brixton, Surrey—Improvements in machinery for attaching the soles of boots and shoes to the upper leathers.—(Communication from Simon S. Bucklin, Brooklyn, Massachusetts, U.S.)
3203. Dudley C. Le Souëf, Twickenham—The improvement of cylinders used in printing calicoes and other textile fabrics.—(Communication from Henry Kundig, George Bertschy, and Joseph P. de Pertheim, Prague, Austria.)

21*st December*, 1861.

3204. John Wakefield, Birmingham, Warwickshire—Improvements in sewing machines.
3205. Timothy Morris, Robert Weare, and Edward H. C. Moncktou, Trafalgar Square—Improvements in submarine and other telegraphic communication, and in apparatus connected therewith.
3206. William Bennetts, Tuckingmill, Camborne, Cornwall—Improvements in the mechanism required for and in the manufacture and composition of gunpowder.
3207. Filippo Grimaldi, Manchester Buildings, Parliament Street—Improvements in rotatory steam boilers.
3208. William M. Williams, Handsworth, Staffordshire—An improvement or improvements in treating coal and other bituminous minerals and peat, in order to obtain solid and liquid hydrocarbons therefrom, and in apparatus to be used for that purpose.
3209. William L. Allchin and William Allchin, Northampton—Improvements in apparatus applicable to the superheating of steam.
3210. William C. Miles, Railway Place, Shoreditch—Improvements in lamp glasses.

3211. Fraser Selby, Surbiton, Surrey—Improvements in boilers for the generation of steam in engines for applying steam for motive power purposes, and in wheels and ways for steam carriages to run on.

3212. William Kempe, Holbeck Mills, Leeds—Improvements in scrays or tables applicable to gig mills, brushing mills and other like machinery.

3213. Charles Osman, Chryssell Road, Brixton, Surrey—Improvements in the manufacture and application of elastic or yielding surfaces for sitting, lying or reclining upon.

24th December, 1861.

3214. John H. Johnson, Lincoln's Inn Fields, and Buchanan Street, Glasgow, Lanarkshire—Improvements in apparatus for cleaning wheat and other grain.—(Communication from Jean P. Fili, Paris.)

3215. Louis R. Bodmer, Thavies Inn, Holborn—Improvements in looms for the manufacture of sacks, knapsacks, mattress cases, and other goods.—(Communication from Charles H. Tessier, Paris.)

3216. Charlotte Smith, Bedford—Improvements in stays.

3217. John Rosindell, Mile End—An improved method of and apparatus for separating solid from liquid substances.

3218. Charlotte Smith, Bedford—Improvements in stays.

3219. Edward Ede, Abercorn Mews, Violet Hill, St. John's Wood—Improvements in the construction of horse shoes.

3220. John F. Harvey, Strand—Improvements in umbrellas and parasols.

3221. Alfred V. Newton, Chancery Lane—Improved means for reducing the friction and wear of slide valves of steam engines.—(Communication from Mr A. Buchanan, Jersey City, New Jersey, U.S.)

3222. Thomas E. Vickers, Sheffield, Yorkshire—Improvements in the wheels of railway engines and carriages, and in the machinery or apparatus to be used in making the same.

3223. Edward B. Sampson, Ham Mills, Stroud, Gloucestershire—Improvements in apparatus for drying wool and other fibres and substances.

3224. John B. Wood, Broughton, near Manchester—Improvements in the manufacture of driving straps or bands, the backs of wire cards and cop tubes.

3225. Francois Laurent and John Casthelaz, Rue Ste. Croix de la Bretonnierre, Paris—Improvements in the manufacture of colouring matters.

3226. John Cochrane, Dudley—Improvements in apparatus employed in sinking cylinders and open coffers for forming foundations under water.

3227. George H. Birkbeck, Southampton Buildings, Chancery Lane—Improvements in the arrangement of traction and connecting apparatus for railway carriages and trains.—(Communication from M. Claude Arnoux, Paris.)

26th December, 1861.

3228. Thomas Simmons and Thomas Timmins, Birmingham, Warwickshire—Certain improvements in urns or vessels for holding and supplying hot water, tea, coffee, or other liquids separately or conjointly, as also in the stands for the same.

3229. Jabez Jones, Liverpool, Lancashire—Improvements in the manufacture of lead, tin, and other metals, or amalgamation of metals of a like nature, fusible at a low temperature into sheets of any thickness or length.

3230. Thomas Standing, Preston, Lancashire—Improvements in cinder sifters and ash receptacles applicable to domestic fire grates.

3231. Louis J. Taulin, South Street, Finsbury—A wind musical instrument, "Taulin's harmonicor."

3232. Joseph Schloss, Cannon Street—Improvements in envelopes for containing photographic portraits and pictures.—(Communication from Simeon Schloss, Paris.)

3233. Nicolas A. Burnier, Lyons, France—Improvements in the manufacture of lace.

3234. James Shepherd, Manchester, Lancashire—Improvements in apparatus for cleansing steam boilers.

3235. Richard Needham, Dukinfield, Cheshire—Improvements in apparatus for cleansing steam boilers and lubricating the pistons of steam engines, and for an improved steam trap.

3236. Henry Dawes, Sale Green, Sale Moor, near Manchester, Cheshire—An improved metal for crinoline.

3237. Joseph N. Palmer, Fenchurch Street—Improvements in cooking stoves and ships' ranges.—(Communication from John Russell, Sydney, New South Wales.)

27th December, 1861.

3238. William Hawksworth, Oldham, Lancashire—Certain improvements in carding engines.

3239. Thomas Silver, Philadelphia, U.S.—Improvements in apparatus for governing or regulating the speed of steam and other engines.

3240. William Turner and John W. Gibson, Dublin—Improvements in rolling bridges.

3241. Peter A. le Comte de Fontaine-Moreau, South Street, Finsbury—Improvements in treating fatty and resinous bodies either in a neutral or acid state.—(Communication from Charles Moinier, St. Ouen, France.)

3242. Thomas Bright, Old Foundry, Carmarthen—Improvements in machinery for cutting hay, straw, and other vegetable substances.

3243. Thomas W. Atlee, Birmingham, Warwickshire—Certain improvements in cocks or taps for drawing off fluids.

3244. William E. Newton, Chancery Lane—Improvements in steam generators.—(Communication from Rafael Rafael, New York, U.S.)

3245. James M'Intyre, New York, U.S.—Improvements in bomb shells and similar projectiles.

3246. Richard A. Brooman, Fleet Street—Improvements in steam generators, and in fire-bars employed therein.—(Communication from Alexandre Friedmann and Emile D'Erlanger, Paris.)

3247. Jean J. H. Fajole and Pascal A. Agostini, Courbevoie, France—An improved composition or improved compositions suitable for painting, varnishing, and coating.

28th December, 1861.

3248. John W. Harland, Chorlton-on-Medlock, Manchester—An improvement or improvements in the manufacture of wood and other types or substitutes therefor, or furniture used by letter-press printers.

3249. Edward Lord, Todmorden, Yorkshire—Certain improvements in machinery for preparing cotton and other fibrous substances.

3250. Arthur Warner, Threadneedle Street—Improvements in the manufacture of hollow articles for military and war purposes.

3251. Michael Henry, Fleet Street—Improvements in fire-arms, and in adapting bayonets or cutting or piercing weapons thereto.—(Communication from Mathieu L. Descoutures, Boulevart Saint Martin, Paris.)

30th December, 1861.

3252. John P. Dormay, James S. Aitkenhead and Thomas Johnson, Wandsworth, Surrey—Improvements in the construction of boats for sailing or rowing.

3253. John Edwards, Aldermanbury—Improvements in the permanent way of railways.

3254. Frederick Tolhausen, Boulevart Bonne Nouvelle, Paris—Improvements in machines for reaping, gathering, and binding harvest produce.—(Communication from Philippe Durand, Esq., Boulevart Bonne Nouvelle, Paris.)

3255. James Gorton, Park House, and Bartholomew Henderson, South Shore, Gateshead, Durham—Improvements in the manufacture of ropes.

3256. George H Birkbeck, Southampton Buildings, Chancery Lane—Improvements in apparatus for raising or forcing water or other fluids.—(Communication from Edward B. B. Barker, Samsoun and Sinope, Black Sea.)

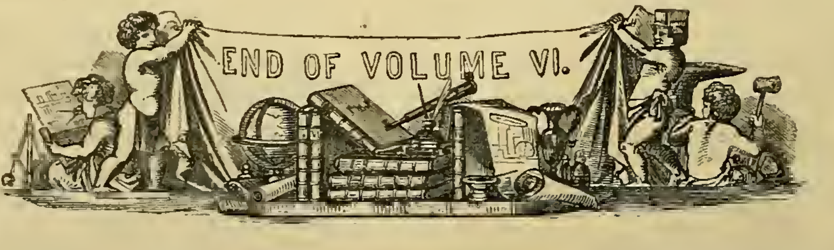
3257. William E. Newton, Chancery Lane—Improvements in the manufacture of cube sugar.—(Communication from Gustavus Finken, Brooklyn, King's County, New York, U.S.)

3258. John B. Payne, Chard, Somersetshire—Improved machinery for the manufacture of laid and other twine, lines, ropes, bands, and other cordage, whether made of hemp, flax, or other fibrous substances, or of wire.

3259. Alexander I. Austen, Millwall—Improvements in the manufacture of night lights.

TO READERS AND CORRESPONDENTS.

Completion of Volume VI., Second Series, of the Practical Mechanic's Journal.—The present Part, No. 168, completes Volume VI., Second Series, of this *Journal*, or the fourteenth volume of the entire work as far as published. The set of volumes may be had from any bookseller, in cloth, lettered in gold, price 14s each; or the parts may be purchased separately, as originally published, at 1s each—most of the parts being obtainable. The volumes may also be had, handsomely bound in half calf, in six double volumes, twenty-four parts in each, with the Plates bound separately to correspond—price 31s 6d for each double and its separate volume of Plates. Volume VI., Second Series, contains nineteen quarto pages of copperplate engravings, nearly 560 engravings on wood, and 344 pages of letterpress,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